Mojave Desert
Air Quality Management District

Final

Mojave Desert Planning Area

Federal Particulate Matter (PM_{10}) Attainment Plan

July 31, 1995

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LIST OF ACRONYMS AND ABBREVIATIONS

BACT	Best Available Control Technology
BLM	Bureau of Land Management
DCP	Dust Control Plan
FCAA	1990 Federal Clean Air Act Amendments
MCAGCC	Twentynine Palms Marine Corps Air Ground Combat Center
MDAQMD	Mojave Desert Air Quality Management District
MDPA	Mojave Desert Planning Area
MPO	Metropolitan Planning Organization
NAAQS	National Ambient Air Quality Standards
NO_x	Oxides of nitrogen
NSR	New Source Review
NTC	Fort Irwin National Training Center (United States Army)
OHV	Off Highway Vehicle
PM_{10}	Particulate matter having an aerodynamic diameter of ten microns or less
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
SEDAB	Southeast Desert Air Basin
SIP	State Implementation Plan
TRC	TRC Environmental Corporation
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

The USEPA has designated certain geographical areas as having violated the NAAQS for PM_{10}. The geographical areas when so designated, become federal nonattainment areas. The FCAA require areas designated nonattainment with the PM_{10} NAAQS, to comply with federal attainment planning requirements. A large portion of the MDAQMD was classified nonattainment and therefore must comply with all the federal requirements associated with PM_{10} attainment planning.

The FCAA requires the state air agency to make revisions to the SIP which include all the necessary elements statutorily required for federal PM_{10} attainment planning by July 20, 1995. The SIP submittal must contain a control strategy plan which provides for the adoption and implementation of RACM in the nonattainment area. In addition, the control strategy plan must demonstrate RFP and attainment with the NAAQS for PM_{10} by the end of the sixth calendar year after being designated nonattainment (December 31, 2000).

The USEPA designated a major portion of the San Bernardino County area of the SEDAB as a PM_{10} nonattainment area. The designation was based on a number of violations which occurred in the populated areas of the MDAQMD during the period 1989-1991. In consideration of the location of the observed violations and the sources of PM_{10}, the Plan identifies a smaller nonattainment area surrounding the heavily populated cities and towns in the MDAQMD. This region includes the Victor Valley, Morongo Basin, Barstow, and Lucerne Valley, and is referred to as the MDPA.

The air quality of the MDAQMD is impacted by both fugitive dust from local sources and occasionally by region-wide wind blown dust during moderate to high wind episodes. This region-wide or "regional" event includes contributions from both local and distant dust sources which frequently result in violations of the NAAQS that are multi-district and interstate in scope. Local sources will be controlled with a strategy that focuses on unpaved road travel, construction, and local disturbed areas in the populated areas, and certain stationary sources operating in the rural Lucerne Valley. It is not feasible to implement control measures to reduce dust from regional wind events. The MDAQMD has estimated that attainment with the NAAQS will be achieved no later than December 31, 2000 within the MDPA. A demonstration of attainment will be based on progress toward attaining the NAAQS after the successful implementation of the control strategy.

CHAPTER 1: INTRODUCTION

Purpose

Statement of Problem

PM_{10} and Its Health Effects

Scope of Plan

Purpose

As a result of the FCAA, new statutory requirements were devised to bring the Country's nonattainment areas into compliance with the NAAQS. Effective January 20, 1994, the USEPA redesignated a significant portion of the Mojave Desert as a nonattainment area with respect to the NAAQS for PM_{10}. This nonattainment area covers a vast geographical region, including the urban areas of Victor Valley and Barstow, the Morongo Basin, along with the rural desert environs reaching to the Nevada and Arizona state lines (see Figure 1-1). With this redesignation, the USEPA invoked official action to give the region a Moderate classification. Because of this USEPA determination, all necessary federal requirements for a "Moderate" nonattainment area must be met. The goal is to achieve air quality clean enough to be in compliance with the PM_{10} NAAQS.

The MDAQMD is the regional air quality planning agency responsible for the desert portion of San Bernardino County and the Palo Verde Valley in Riverside County (see Figure 1-2). The newly designated PM_{10} nonattainment area includes most of the geographical area under the jurisdiction of the MDAQMD, but excludes the Palo Verde Valley. The MDAQMD is responsible for developing a SIP revision to address the PM_{10} planning requirements of federal law.

The purpose of this document is to provide a complete description and submittal to USEPA of the PM_{10} attainment planning elements which the MDAQMD will implement to bring the nonattainment area into compliance with federal law. Most importantly, this document will serve as a planning tool for reducing PM_{10} pollution in the MDPA. The PM_{10} Plan sets forth an air quality improvement program for the region which will be implemented by both the public and private sector of the community.

Statement of Problem

USEPA has set forth two federal standards for PM_{10}: 150 $\mu g/m^3$ for a 24-hour average; and 50 $\mu g/m^3$ for an annual average. The USEPA redesignated the MDAQMD based on three violations of these standards which occurred in 1989. Subsequently, there were several violations recorded within the urban portions of the nonattainment area during the period of 1989-1991. Several of the PM_{10} violations occurred during intervals of strong local winds and also at times when adjacent desert areas in other air districts experienced exceedances. Also, the 1989-1991 period of monitored PM_{10} violations coincided with a prolonged and intense phase of construction activity associated with the acute urban development of the Mojave Desert. In the period since 1991, there have been no recorded exceedances of the federal PM_{10} standards within the MDAQMD. MDAQMD believes that the PM_{10} violations can be attributed primarily to the heavy concentration of fugitive dust sources in and around the urbanized areas, along with dust generated regionally due to large-scale high wind events.

The Moderate classification requires the MDAQMD to develop and adopt a SIP revision that provides for the adoption and implementation of RACM and RACT to reduce PM_{10} emissions arising from human activities. The SIP revision must include quantitative milestones to be achieved every three years. Such milestones must demonstrate RFP in reducing PM_{10} emissions toward attainment of the NAAQS. In addition to these RFP requirements, the SIP revision must include a demonstration that the plan will provide for attainment of the federal PM_{10} standard by the earliest practicable date (not later than December 31, 2000).

PM_{10} and Its Health Effects

PM_{10} emissions can be generated by natural processes in the environment and by the activities of humans. PM_{10} emissions can result from a variety of processes and activities, such as forest fire smoke, fine soil blowing off desert dry lakes, vehicles grinding up soil, and graded lots eroding away. Although particulate matter is usually directly emitted into the air as primary emissions, other processes can occur which form "Secondary" PM_{10} in the atmosphere as a result of chemical reactions.

These microscopic particles can be suspended in the air and carried long distances. Thus, PM_{10} can be an air pollutant which exists over large geographical expanses, potentially affecting numerous people. The threat from these minute particles arises because PM_{10} can be inhaled deep into the lungs, where they can persist and cause respiratory damage. The health risk from an inhaled dose of particulate matter depends on the size, composition, and concentration of the particulate. Larger particles of PM_{10} tend to deposit in the tracheal-bronchial region, and smaller ones in the alveolar region.

A USEPA review of medical studies on PM_{10} indicates that these fine particles are associated with numerous adverse health effects. Such documented ill effects have included:

- Reduced lung function
- Increase in number of asthma attacks
- Aggravation of bronchitis
- Premature death
- Respiratory disease
- May even cause cancer

Air pollution does not affect the health of exposed persons with equal severity. Although everyone is potentially affected by PM_{10} exposure, certain sensitive groups are especially vulnerable. These at-risk individuals include people with chronic obstructive lung disease or cardiovascular disease, individuals with influenza and asthma, elderly individuals, and children.

Scope of Plan

This document provides a narrative discussion addressing specific topics. Chapter 2 addresses the technical issues surrounding the plan, including the nonattainment area, chemical filter analysis, and exceedance days. Chapter 3 provides a summary of the different PM_{10} emission inventories. Chapter 4 details existing and future control strategies, and presents an implementation schedule. Chapter 5 presents the demonstration of attainment. Chapter 6 discusses conformity budgets for transportation and general federal actions. The appendices provide the technical support documentation used in the preparation of the text in Chapters 1-6.

Figure 1-1. Federal PM_{10} Nonattainment Areas

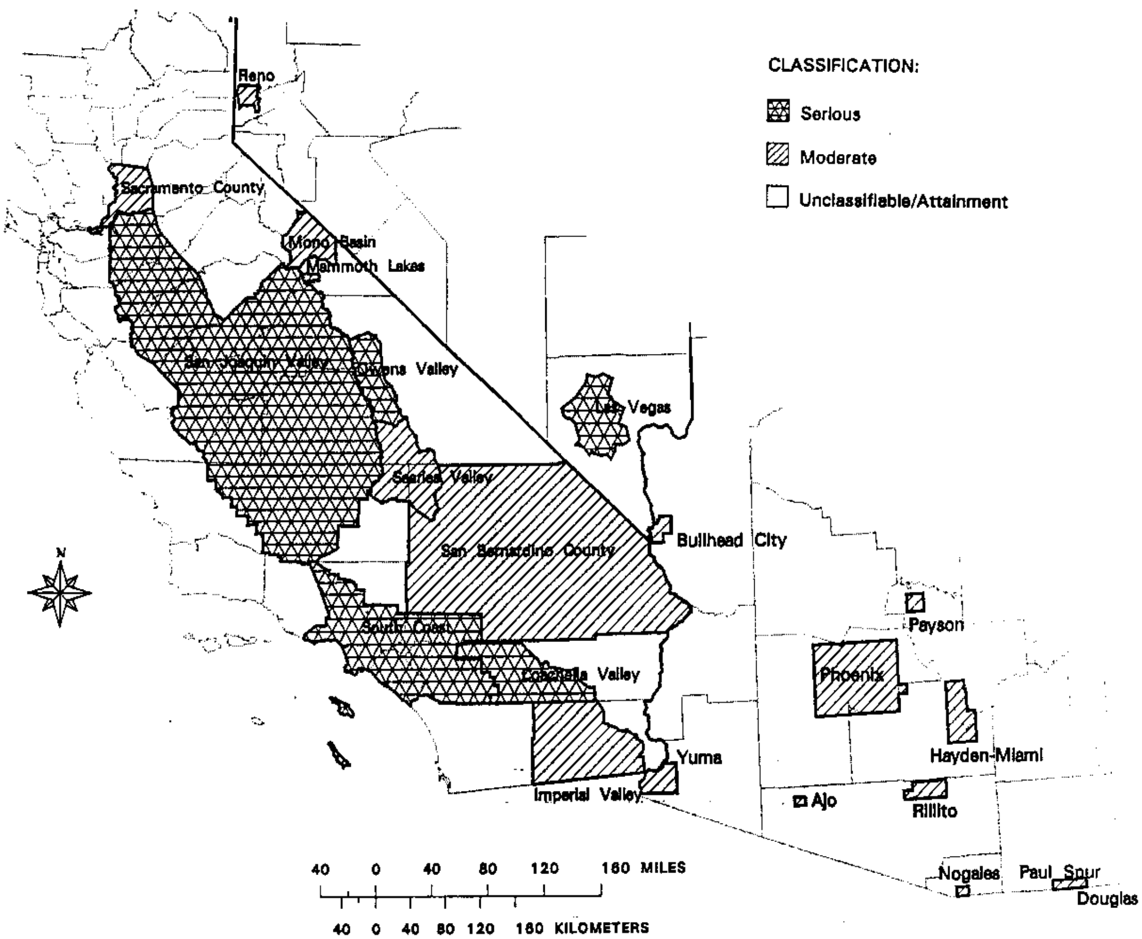
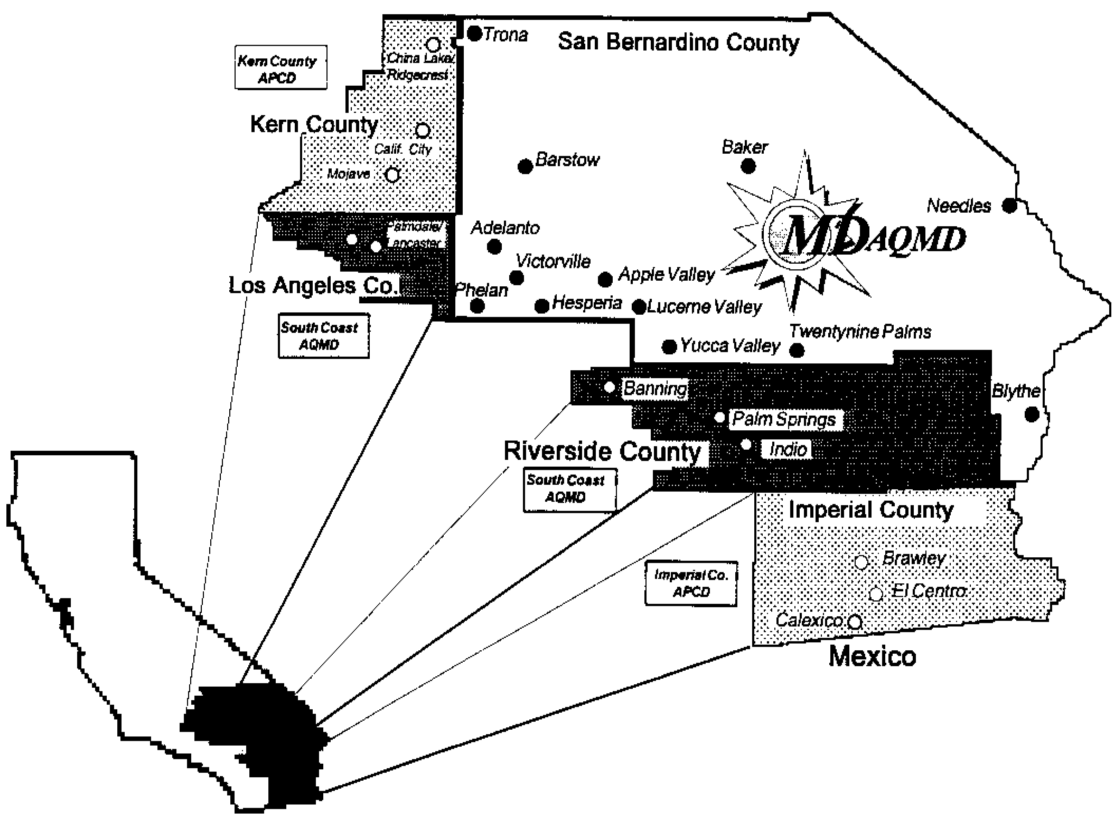


Figure 1-2. Mojave Desert AQMD Jurisdiction



CHAPTER 2: TECHNICAL ISSUES

Federally Designated Nonattainment Area

Mojave Desert Planning Area

Filter Chemical Analysis

PM_{10} Exceedance Days and Design Values

Federally Designated Nonattainment Area

The region the USEPA designated nonattainment for PM_{10} includes the majority of the San Bernardino County area of the Southeast Desert Air Basin (see Figure 1-1). It does not cover the MDAQMD's previously designated PM_{10} nonattainment region, the Searles Valley Planning Area, which contains the very small extreme northwest corner of the MDAQMD. Nor does it include the Palo Verde Valley in Riverside County, which is also under jurisdiction of the MDAQMD.

<u>PM_{10} Monitoring Stations</u>

The MDAQMD has five PM_{10} monitoring stations in the nonattainment area, located in population centers (see Figure 2-1). Appendix A contains information on the individual stations, including their exact location during the time period of the recorded PM_{10} exceedances. The air monitoring stations employ a Sierra Anderson Model 321 high-volume sampler with a 1200 size selective inlet head. The PM_{10} equipment is operated to record measurements on a once-every-sixth-day schedule. All of the PM_{10} monitors in the network, except the Lucerne Valley site, are located in conjunction with a meteorological station which details the important parameters of wind speed and wind direction. In addition, the PM_{10} samples taken were weighed and analyzed to determine certain chemical fractions which assist in determining the specific source contributions to the monitored values.

<u>Population</u>

The nonattainment area covers over 18,000 square miles of desert terrain, but includes only 315,000 persons. The area has been, and remains to this day, a relatively rural and sparsely populated county. The region has only a few densely populated centers of urban development, all of which fall in the PM_{10} planning area. These urban areas (e.g., Victor Valley and Morongo Basin) did not experience dramatic growth until the 1980's with a peak occurring in the period 1989-1991. In 1990, the MDPA had a population of approximately 312,202 persons. The majority of these individuals (63%) reside in the Victor Valley region alone. An additional 19% of the people live in the Morongo Basin, and 13% reside in the Barstow area. Although Lucerne Valley is not an incorporated city, it is an identifiable community that is recognized in this plan as a separate populated area. Collectively, these four areas contain 97 percent of the population and consequently represent the majority of the population impacted by PM_{10}.

<u>Climate</u>

The climate of the area is characteristic of a desert environment. The large San Gabriel and San Bernardino mountain ranges block the desert from the cool, moist coastal air of the South Coast Air Basin (SCAB). The Mojave Desert region generally experiences hot, dry summers and mild winters with very little annual rainfall (from 2 to 5 inches per year). Meteorology is influenced by a moderately intense anticyclonic circulation, except during periods of frontal activity during the winter. On average, 20-30 frontal systems (e.g., storms) move into the MDAQMD each winter. During the summer, the MDAQMD is generally influenced by a Pacific Subtropical High cell that sits off the coast of California. Prevailing winds are out of the west and south, tending to a west to east flow across the area.

Mojave Desert Planning Area

The MDAQMD has determined that the Federally designated nonattainment area covers a larger region than was warranted, based on several facts:

- The locations of the existing PM_{10} monitoring sites: The five monitoring sites are located in the southwest corner of the nonattainment area. This means the majority of the northern and eastern portions of the area are not monitored for PM_{10}. Nor does the monitor data reflect ambient air in the northern and eastern portions of the nonattainment area.
- The location of the population: The vast majority of the nonattainment area's population and associated anthropogenic PM_{10} sources (97 percent) live and are located in the southwestern communities.
- The location of emission sources: With the significant exception of the two large military bases, most major PM_{10} sources, including unpaved roads, fall within the southwest corner of the nonattainment area. Sixty-four percent of the PM_{10} emissions occur within the southwest corner of the nonattainment area.
- The Mojave National Preserve: The creation of the Mojave National Preserve will result in a shifting of unpaved and off road activities from the remote eastern Mojave Desert to established areas elsewhere. This will result in a lowering of the PM_{10} emission inventory for the unclassified eastern and northern Mojave Desert areas.

As a result, the MDAQMD has defined a smaller nonattainment area, referred to as the MDPA, which does correspond to the existing PM_{10} monitor stations and data (refer to Figure 2-1). This plan will demonstrate attainment of the PM_{10} NAAQS within this MDPA. The FCAA (§110(k)(6)) authorizes USEPA to consider corrections to the State Implementation Plan, including nonattainment area boundaries.

The boundary of the MDPA is defined as follows: That portion of San Bernardino County: north and east of a line running east from the Los Angeles County boundary along the township line common to T3N and T2N, then south along the range line common to R2E and R3E; and south and west of a line running east from the Kern County boundary along the township line common to T11N and T12N, then south along the range line common to R4E and R5E , then south and east along the western and southern boundaries of the Twentynine Palms Marine Corps Air Ground Combat Center, then south along the range line common to R12E and R13E.

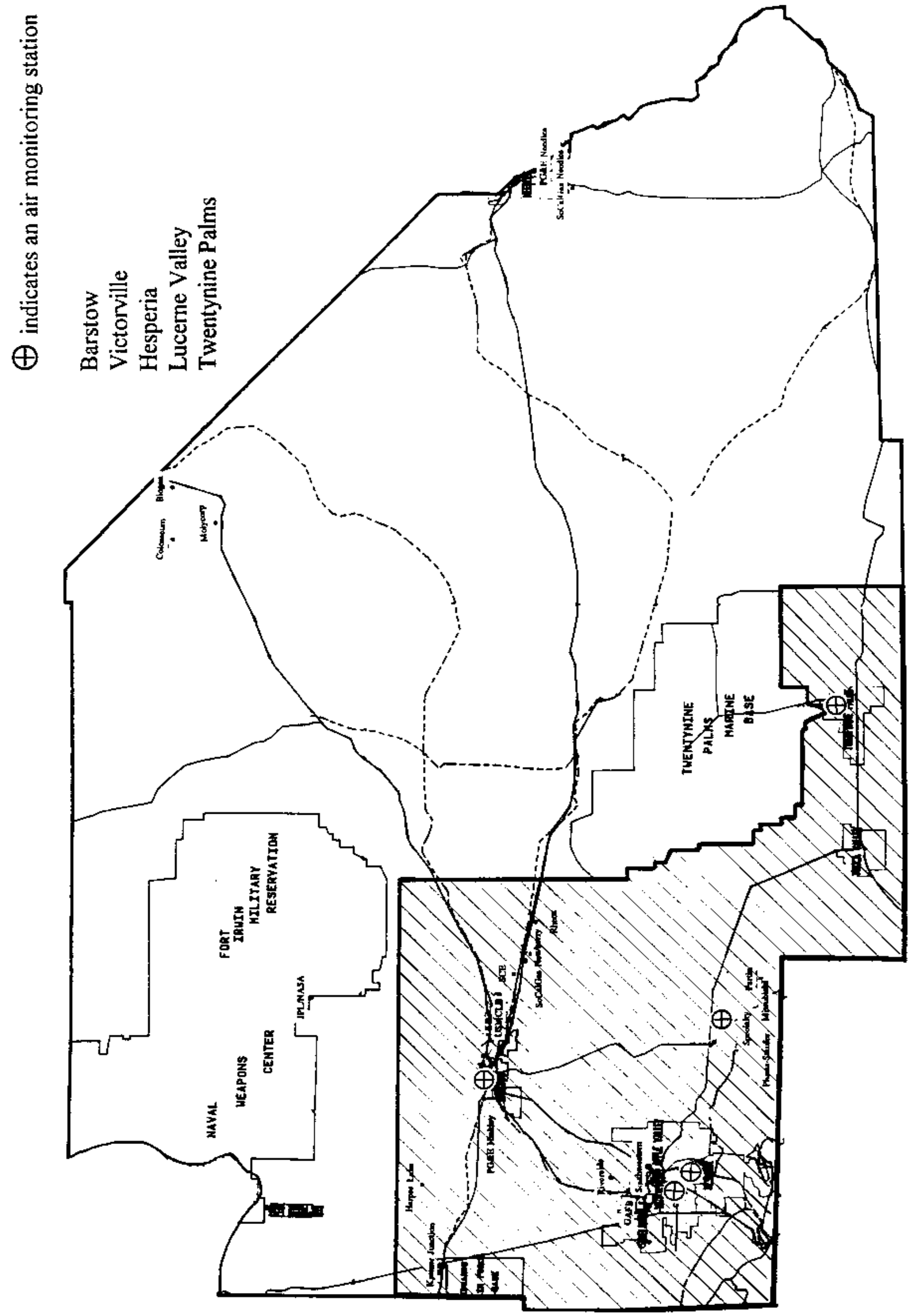
Military Base PM_{10} Monitoring and Modeling

Based on discussions with CARB and USEPA, exclusion of the two large military bases (Fort Irwin National Training Center (NTC) and Twentynine Palms Marine Corps Air Ground Combat Center (MCAGCC)) from the nonattainment area is contingent upon two actions: (1) perimeter PM_{10} monitoring around each facility to demonstrate that each facility does not cause or contribute to NAAQS exceedances, and (2) coarse PM_{10} dispersion modeling to demonstrate that each facility cannot cause or contribute to PM_{10} NAAQS exceedances under worst-case meteorological conditions.

PM_{10} monitoring is ongoing at NTC. A monitoring network began operating in October 1994 with three sites (central, southern, and western), to be supplemented by several northern and eastern sites as technical difficulties are overcome. MCAGCC has submitted a draft PM_{10} monitoring work plan to both MDAQMD and CARB for review and comment. It is evident that the military already has and will commit to PM_{10} monitoring to document representative actual PM_{10} concentrations at their facility boundaries. Written commitments from both facilities to perform at least 12 months of PM_{10} monitoring are included in Appendix A.

CARB has agreed to perform coarse PM_{10} dispersion modeling on both NTC and MCAGCC. This dispersion modeling will estimate PM_{10} concentrations at the ambient air boundaries around each facility under worst-case meteorological conditions experienced in 1994. The modeling is not expected to be completed until after this Plan is adopted. The MDAQMD is committed to revising this SIP submission, should the dispersion modeling or the monitoring programs demonstrate that NTC and/or MCAGCC should be included in the attainment planning process.

Figure 2-1. Mojave Desert PM_{10} Planning Area



Filter Chemical Analysis

The MDAQMD contracted with TRC to perform primary chemical analysis of quartz fiber filters from selective size inlet PM_{10} monitors for the Mojave Desert Planning Area exceedance days. A summary of the results of that analysis is presented here. Significant portions of the final analysis report are presented in Appendix B.

<u>Chemical Analysis Procedure</u>

The MDAQMD provided the quartz filters from selective size inlet high volume monitors from 13 of the 16 recorded PM_{10} exceedances to TRC for analysis. Two of the remaining filters were on media (glass fiber) that could not be analyzed and another was unavailable. The MDAQMD also provided two soil samples from each monitor site environment, a total of ten samples. TRC analyzed the thirteen filters and the ten soil samples for Al, K, Ca, Ti, Mn, Fe, Zn, Rb, Sr, Pb, organic carbon, elemental carbon, SO_4, NO_3, and CO_3. The filter analysis results were then compared to a set of source profiles using a chemical mass balance model to identify which sources were dominant contributors to the material on the filter. The results of the soil sample analyses established the crustal material source profile. The crustal source profile was supplemented by source profiles for clinker tower exhaust, residential wood combustion, secondary sulfate, secondary nitrate, brake wear, tire wear, limestone, and lime.

The EPA version 7.0 Chemical Mass Balance receptor model was used to determined source category apportionments. The modeling was performed in a manner consistent with EPA's *Protocol for Applying and Validating the CMB Model* (USEPA, 1987).

<u>Chemical Analysis Results</u>

A majority of the filters were dominated by crustal material with nine of the thirteen having an average of 77 percent crustal material. The Barstow filter from October 13, 1989 was an exception, containing unusually high zinc and barium concentrations which have not been explained, and which resulted in a very high unexplained weight fraction (57 percent). Three of the five Lucerne Valley filters (February 16, 1990, May 23, 1990, and December 19, 1990) had significant calcium and carbonate concentrations (17 to 36 percent), which have been associated with local limestone mining and processing industries. These three filters also had high unexplained weight fractions (33 to 49 percent). TRC indicated that the unexplained weight could be waters of hydration compounded with limestone on the filter, as water was not a target of filter analysis. Accordingly, the calcium and carbonate source apportionment should include a portion of the unexplained mass (as associated water), and TRC suggested an equal weight of water. This would make the limestone industry the dominant source category for three of the five Lucerne Valley filters at approximately seventy percent of the filter weight.

PM_{10} Exceedance Days and Design Values

To understand the PM_{10} problem in the MDPA adequately, each exceedance day had to be examined closely. MDAQMD staff gathered data and information which was available for the time period covering the exceedance in question. First and foremost, the exceedance day was examined to determine if there were factors which may have influenced the day's PM_{10} measurement. MDAQMD staff then formulated, wherever possible, the most likely cause leading to the recorded exceedance.

The MDAQMD utilized USEPA guidance (*Guideline on the Identification and Handling of Ambient Air Qualifying Data Affected by Special Events or Special Conditions*) that addressed analyzing air monitoring data that may be affected by special events or special conditions. The purpose of review of each exceedance day was to determine whether that particular exceedance day experienced events that meet the "special" criteria referenced in the guidance. The MDAQMD staff performed a preliminary evaluation of the exceedance days and found several that appear to have been unduly influenced by an event or a condition such that special regulatory handling of the data is warranted. Information included in Appendix A is being supplied as documentation to support the special event claims being made on these specific exceedance days in question.

There were 16 individual PM_{10} exceedances in the MDPA during the time period of 1989-1994. A number of these exceedances fell on the same day but at different locations. Table 2-1 presents each exceedance value, with its cause. Exceedances with a “Local” cause form the basis for the control strategy and attainment demonstration.

Table 2-1. Monitoring Results of PM_{10} Exceedances

Location	Date	PM_{10} Concentration ($\mu g/m^3$)	Cause
Twentynine Palms	July 9, 1989	155	Local
Barstow	October 10, 1989	191	Local
Lucerne Valley	February 16, 1990	317	High Calcium
Lucerne Valley	May 23, 1990	313	High Calcium
Lucerne Valley	November 1, 1990	195	Local
Hesperia	November 1, 1990	171	Local
Twentynine Palms	November 13, 1990	286	Local
Victorville	November 19, 1990	181	Local
Barstow	December 19, 1990	381	High Winds
Lucerne Valley	December 19, 1990	187	High Winds
Twentynine Palms	December 19, 1990	297	High Winds
Hesperia	February 17, 1991	320	High Winds
Lucerne Valley	February 17, 1991	389	High Winds
Twentynine Palms	February 17, 1991	297	High Winds
Victorville	February 17, 1991	439	High Winds
Barstow	May 30, 1991	197	High Winds

Design Values

Federal guidance dictates that the MDAQMD select annual average and 24-hour design values. The annual average design value is the average of quarterly annual averages, calculated from all monitored PM_{10} data, with data gaps filled-in using Appendix K of Part 50 CFR. The MDAQMD has conservatively averaged the annual values from 1989 through 1991 by neglecting the more recent years with their lower values. Federal guidance provides a protocol for establishing 24-hour design values, but due to the relatively limited monitored PM_{10} data the highest monitored 24-hour exceedance becomes the design value. The design values for each air monitoring site are presented in Table 2-2.

The most conservative value is used as the MDPA design value. This is the 286 $\mu g/m^3$ reading at Twentynine Palms on November 13, 1990, a value ninety percent above the NAAQS. This design value represents the MDPA under the worst-case influence of local crustal sources. Annual average design values are ignored, as the highest (58 at Victorville) is only sixteen percent over the NAAQS.

In addition to the MDPA design value, a separate design value has been established for the Lucerne Valley region to represent the Lucerne Valley region under the worst case influence of local high calcium sources. This is the 317 $\mu g/m^3$ reading recorded on February 16, 1990. This separate design value for the Lucerne Valley region is supported by the TRC chemical filter analysis which identified three filters from Lucerne Valley with high calcium chemical compositions very different from the filters from the other monitoring sites.

Table 2-2. Design Values ($\mu g/m^3$)

Zone	Annual Average	24-Hour	Exceedance Date
Barstow	48	191	October 13, 1989
Hesperia	54	171	November 1, 1990
Lucerne Valley High Calcium	40	317	February 16, 1990
Lucerne Valley Crustal	40	195	November 1, 1990
Twentynine Palms	43	286	November 13, 1990
Victorville	58	181	November 19, 1990
NAAQS	*50*	*150*	

CHAPTER 3: EMISSION INVENTORIES

General

Source Categories

Source Contributions

General

The 4600 square mile MDPA contains a wide variety of PM_{10} sources generating approximately 107,000 tons of PM_{10} in 1990 (refer to Appendix C). The majority of these sources are fugitive and not associated with exhaust stacks or primary emission points. In addition, fugitive emissions are difficult to quantify, as they are usually the result of sporadic and wide-spread activities, such as wind or vehicle travel. Accordingly, the PM_{10} emission inventory for the planning area is an estimate, determined using best available activity data and emission calculation methods, and should be considered an approximation. Most non-stationary sources are inventoried using planning area-wide assumptions, such as a single value for silt content, average vehicle speed, number of trips per mile, etc. The MDAQMD believes these MDPA-wide constants are justified based on the large number of sources within each category; which allows individual differences to average out.

Future year emission inventories are estimated through the use of growth, or change, factors, which indicate the amount of emissions expected to be emitted in a future year relative to the baseline. The growth codes used are presented on page C-37 of Appendix C.

Source Categories

City and County Unpaved Road Travel: This is a major category, with vehicle travel on city and County unpaved roads generating 50,800 tons in 1990, or 48 percent of the planning area total. This category represents dust generated by vehicle travel on city and County maintained and unmaintained unpaved roads. The County maintains approximately 500 miles of unpaved roads, and tracks another 3500 miles of unmaintained unpaved road. Local jurisdictions track upwards of 1100 miles of unpaved roads. These roads carry significant amounts of traffic in and around populated areas (County-maintained unpaved roads average 100 trips per day). Local jurisdictions, and private parties are actively paving unpaved roadways through out the planning area; 633 miles of unpaved road have been paved since 1989. The MDAQMD assumes that travel activity is shifting away from unpaved roads as the populated areas of the planning area are incorporated and roads are paved. Local jurisdictions have indicated that all new and recent construction are required to have paved road surfaces and paved access. As a result, city and County unpaved road travel emissions have fallen, and are expected to continue to shrink.

BLM Land Activity: This is a major category, with vehicle activity on Bureau of Land Management lands generating 10,900 tons in 1990, or 10 percent of the planning area total. This category represents dust generated by vehicle travel on BLM lands, including casual vehicle use and specific vehicle use, such as races and OHV area use. Filming activity on BLM lands is also addressed. The BLM maintains several large OHV areas within the planning area, covering 582 square miles (Johnson Valley, Stoddard Valley, and El Mirage). Activity on BLM lands is forecasted to increase proportionally with the planning area population.

City and County Unpaved Road Wind Erosion: This is a significant windblown fugitive dust category, generating 14,100 tons in 1990 (13 percent of the total planning area inventory) and shrinking through 2000. This category estimates the emissions from wind erosion of city and County maintained and unmaintained unpaved roads. These roads are located in and around populated areas. Unpaved road wind erosion is a major contributor on design days as windy conditions greatly increase emissions from disturbed soils. Unpaved city and County road wind erosion are also estimated to be declining as unpaved road mileage is paved throughout the planning area (633 miles have been paved since 1989). The MDAQMD assumes that no significant additional unpaved road mileage will be generated to replace that converted to paved, as the existing paved and unpaved road network covers the populated portion of the planning area.

Construction: This is a significant windblown fugitive dust category, with construction generating 8556 tons in 1990 (eight percent of the total planning area inventory) and shrinking through 2000. This category estimates the overall emissions from residential, commercial, industrial, and road construction and demolition, including soil disturbance due to surface preparation and equipment use. Construction and demolition activity is associated with population and population centers. Construction is a major contributor on design days as windy conditions greatly increase emissions of erodible soils from disturbed surfaces. Construction activity was at an all-time high during the 1989-1990 time period, and the planning area has had a housing surplus since. Forecasted construction activity assumes levels similar to 1991, at the historical high.

Paved Road Dust Entrainment: This is a significant category, with vehicle travel on paved roads generating 7600 tons in 1990 (seven percent of the total planning area inventory) and growing through 2000. This category estimates the dust generated when vehicles grind and lift solid material (usually soil) off paved surfaces and into the air.

City and County Disturbed Areas: This is a significant windblown fugitive dust category, generating 5900 tons in 1990 (six percent of the total planning area inventory) and remaining level through 2000. This category estimates the emissions from wind erosion of disturbed areas (except unpaved roads and construction sites) within populated areas. Disturbed areas are a major contributor on design days as windy conditions greatly increase emissions from disturbed soils. Disturbed areas in and around the populated areas are expected to remain constant as growth continues, due to constant development.

BLM Unpaved Road Wind Erosion: This is a significant windblown fugitive dust category, generating 2500 tons in 1990 (two percent of the total planning area inventory) and remaining level through 2000. This category estimates the emissions from wind erosion of unpaved roads on BLM (and State) property. The vast majority of these roads lie in unpopulated areas, in the north and east of the planning area.

Stationary (Industrial) Sources: This is a minor category, totaling 2650 tons in 1990 (two percent of the total planning area inventory) and increasing slightly through 2000. This category includes PM_{10} emissions from all commercial and industrial facilities. This category is an insignificant contributor except in Lucerne Valley, where substantial industrial fugitive emissions are the largest contributor to the design day. As a result, the Lucerne Valley has a separate regional attainment demonstration.

Stationary source emissions fluctuate as facilities shut down and start up, with year-to-year economic variations

Miscellaneous Area Sources: This is a minor category, totaling 1400 tons in 1990 (one percent of the total planning area inventory) and growing through 2000. This category includes all area source categories other than the major fugitive and windblown fugitive dust categories. For example, this category includes wildfires, natural gas and wood fuel burning, agricultural activity, and off-road vehicle exhaust (such as locomotives). Miscellaneous area sources are mainly tied to population and housing activity, with the remainder associated with employment and agricultural activity. Each of these economic activities is forecasted to increase through the year 2000.

Mobile Source Exhaust and Tire Wear: This is a minor category, totaling 1323 tons in 1990 (one percent of the total planning area inventory) and declining through 2000. This category describes PM_{10} emissions due to licensed vehicle engine exhaust and tire wear, and these vehicles concentrate their activity on paved and maintained unpaved road surfaces. These emissions are declining due to improved tire and engine technology.

National Park and Forest Activity: This is a minor category, totaling 1106 tons in 1990 (one percent of the total planning area inventory) and expected to remain level through 2000. This category describes emissions generated by vehicular traffic on roads and major tracks throughout those portions of the San Bernardino National Forest and Joshua Tree National Park within the planning area.

National Park and Forest Unpaved Road Wind Erosion: This is a minor category, totaling 111 tons in 1990 (a negligible portion of the total planning area inventory) and expected to remain level through 2000. This category describes the emissions generated by wind erosion of unpaved roads within the planning area portions of the San Bernardino National Forest and Joshua Tree National Park.

Source Contributions

Source contributions have been determined for the planning area and for the Lucerne Valley region. The annual average contributions are proportional to relative emissions from each source category, in addition to constant contributions from background and transport. The 24-hour contributions are adjusted to reflect the interpretation that windblown fugitive dust categories are contributing the additional increment on the design value days, which are "high wind" days (with the significant exception of the Lucerne Valley region, where stationary fugitive sources are also adjusted for high winds). High wind effects are accounted for by increasing "windblown fugitive dust sources" (construction, city & county unpaved road wind erosion, and city & county disturbed areas) to account for the increased concentrations sampled on the design day.

<u>Background</u>
While the lowest PM_{10} concentration measured within the MDAQMD is 3.9 $\mu g/m^3$, the MDAQMD believes that local sources contribute to all PM_{10} concentrations in the MDPA. All of the MDPA monitoring sites are located in and around anthropogenic sources of dust, so none are considered background sites. The MDAQMD selected 3.0 $\mu g/m^3$ as a background value because it was consistent with the lowest measured values and it is the background value used in the 1994 Coachella Valley PM_{10} SIP, representing a similar desert environment.

<u>Transport</u>
The MDAQMD assumes the overwhelming ozone and ozone precursor transport from upwind air basins will include some nitrate and sulfate aerosol or secondary particulate. The planning area contains relatively limited oxide of nitrogen and sulfur sources. Direct, primary particulate transport is assumed to be overwhelmed by local sources under the light to medium wind conditions on the design days. As a result, transport contributions are estimated as half of the measured total nitrate and sulfate content. Nitrate and sulfate content was determined through chemical analysis when each filter was initially weighed, and again by TRC as part of their chemical filter analysis. Appendix A contains the results of the initial filter chemical analysis.

<u>Design Day Contributions</u>
Tables 3-1 and 3-2 present inventories and concentration contributions by source category for the MDPA and the Lucerne Valley region. Inventories and source contributions are included for design days and the attainment year (2000). The largest emitting source category contributes the majority of each annual average design day concentration. The largest emitting source category is city and County unpaved road travel. The windy exceedance day contributions are overwhelmingly impacted by windblown fugitive dust source categories, such as construction activity, city & County unpaved road wind erosion, and city & County disturbed areas.

The Lucerne Valley region represents a special case: the region contains significant industrial facilities with major raw limestone and processed limestone fugitive sources. The industrial fugitive emissions are considered "windblown" and have been identified as majority contributors to the monitor site via chemical analysis (calcium and calcium carbonate). Accordingly, the Lucerne Valley source contribution follows the results of the chemical analysis, estimating the industrial contribution at approximately 71 percent. In addition, the Lucerne Valley monitoring site experienced unusual construction activity immediately upwind; this activity is accounted for by allocating half of the crustal contribution to construction/demolition (six percent).

Table 3-1: Estimated Inventory and Source Contributions
Annual and 24-Hour Design Values

Mojave Desert Planning Area

	Design Values (1990)				Attainment Year (2000)		
	Inventory (tpy)	percent (%)	Annual (ug/m^3)	24 Hour (ug/m^3)	Inventory (tpy)	percent (%)	24 Hour (ug/m^3)
Background			3.0	3.0			3.0
Transport			3.5	3.5			3.5
City and County Unpaved Road Travel	50802	48	24.5	24.5	23691	28	11.4
BLM Land Activity	10860	10	5.2	5.2	18888	22	9.1
Paved Road Dust Entrainment	7558	7	3.6	3.6	10732	13	5.2
Stationary (Industrial) Sources	2649	2	1.3	1.3	2829	3	1.4
Miscellaneous Area Sources	1414	1	0.7	0.7	1850	2	0.9
Mobile Source Exhaust and Tire Wear	1323	1	0.6	0.6	1003	1	0.5
National Park and Forest Activity	1106	1	0.5	0.5	1106	1	0.5
Windblown Fugitive Dust Sources:							
City and County Unpaved Road Wind Erosion	14098	13	6.8	110.0	7895	10	61.6
Construction	8556	8	4.1	66.7	8556	10	66.7
City and County Disturbed Areas	5914	6	2.9	46.1	5914	7	46.1
BLM Unpaved Road Wind Erosion	2476	2	1.2	19.3	2476	3	19.3
Natinal Park and Forest Road Wind Erosion	111	0	0.1	0.9	111	0	0.9
Totals:	106867		58.0	285.9	85051		230.1

Table 3-2: Estimated Inventory and Source Contributions
Annual and 24-Hour Design Values

Lucerne Valley Region

	Design Values (1990)				Attainment Year (2000)		
	Inventory (tpy)	percent (%)	Annual (ug/m^3)	24 Hour (ug/m^3)	Inventory (tpy)	percent (%)	24 Hour (ug/m^3)
Background			3.0	3.0			3.0
Transport			2.5	2.5			2.5
City and County Unpaved Road Travel	4553	64	22.2	22.2	4444	63	21.7
On Road Dust Entrainment	111	2	0.5	0.5	158	2	0.8
Miscellaneous Area Sources	38	1	0.2	0.2	47	1	0.2
Mobile Source Exhaust and Tire Wear	19	0	0.1	0.1	15	0	0.1
Windblown Fugitive Dust Sources:							
City and County Unpaved Road Wind Erosion	1378	19	6.7	36.6	1367	20	36.3
Stationary (Industrial) Sources	783	11	3.8	228.0	783	11	228.0
City and County Disturbed Areas	122	2	0.6	3.2	122	2	3.2
Construction	70	1	0.3	20.6	70	0	20.6
Totals:	7074		40.0	317	7006		316.4

CHAPTER 4: CONTROL STRATEGY

General

Existing MDAQMD Dust Controls

Amending MDAQMD Rules for Fugitive Dust Control

Selected Control Measures

Implementation Schedule

General

Fugitive dust emissions contribute significantly to the PM_{10} nonattainment status of the region. This section discusses both existing and proposed control measures designed to reduce fugitive dust emissions. Since each exceedance at the different geographical locations was caused by a varying mix of sources, the control strategy must be specifically tailored to address overall planning area needs. These measures are designed to achieve the necessary emission reductions for the planning area. The goal of this strategy is to achieve and maintain attainment of the federal PM_{10} standards for the region as a whole.

This chapter will provide an overview of the existing controls in the region and discuss any planned modifications of current rules and requirements. In addition, this chapter details the proposed control measures to be implemented in the planning area by early 1998. The suggested control strategy will focus on Construction and Demolition Activities, Unpaved Roads, City and County disturbed areas, BLM lands, and certain Lucerne Valley industrial facilities.

The USEPA issued a guidance document listing available control measures for fugitive dust sources (see Appendix D). The focus of the federal control strategy is to reduce fugitive dust emissions, with an emphasis on preventing, rather than mitigating them. The MDAQMD reviewed the suggested available control measures for their applicability and suitability to the sources in the desert nonattainment area. Control measures that were deemed appropriate were considered further based on their feasibility and effectiveness. In addition, the MDAQMD considered the financial impact that certain control measures might have on local government. The following sections will elaborate on the control strategy addressing the PM_{10} sources within the planning area. The justifications for not utilizing various USEPA suggested control measures are detailed in Appendix D.

Existing MDAQMD Dust Controls

Prior to the development of this plan there have been other efforts made to control PM_{10} from various source categories. Notably, the MDAQMD has instituted permit requirements on industrial facilities which resulted in control technology to reduce PM_{10} from smokestacks and other point sources of particulate pollution. At a minimum, most stationary sources have RACT, if not BACT, for process sources of PM_{10}. In addition, many stationary sources have voluntarily implemented fugitive dust controls to reduce PM_{10} at their sites from 1989 to present. The collective emission reductions from stationary sources have been accounted for in their individual emission inventories, thus allowing the region to have lower forecasted emission inventories in future years. The cumulative total reductions will be accounted for during the process of determining RFP towards the attainment and maintenance of the PM_{10} NAAQS.

The MDAQMD currently has three rules which specifically address PM_{10} emissions, especially fugitive dust. These rules are as follows: Rule 401 - *Visible Emissions*; Rule 402 - *Nuisance*; and

Rule 403 - *Fugitive Dust*. These rules are enforced by the MDAQMD Compliance personnel across the entire nonattainment area.

Amending MDAQMD Rules for Fugitive Dust Control

Certain portions of existing rules may be modified to have the effect of strengthening the rules toward greater PM_{10} control. In addition, the MDAQMD may institute a more comprehensive fugitive dust rule, based on MDAQMD Rule 403.1 - *Respirable Particulate Matter*, a rule which currently applies only to a portion of the MDAQMD outside of the MDPA The net effect of any rule or regulation to be developed is to provide an effective enforcement mechanism for various PM_{10} control measures.

The proposed change to regulatory control of PM_{10} is aimed at reducing emissions from four major source categories: (1) industrial activities, (2) construction/demolition activities, (3) disturbed areas, and (4) unpaved road travel. Most targeted sources in these categories fall within the jurisdiction of local government or are industrial facilities located in Lucerne Valley. Collectively, these sources will be required to implement certain reasonably available control measures for PM_{10} emission reductions. Any modification to existing rules or development of a new rule will be subject to the MDAQMD's rule development process. This will allow the public, affected industry and other governmental agencies full public review and comment on the proposed items under development. In the future, the MDAQMD will conduct public workshops and hearings on any revisions to this Plan or MDAQMD rules, and any PM_{10} program under development by the MDAQMD.

Selected Control Measures

This section identifies the available control measures selected for implementation. This particular mix of control strategies was chosen based on the combined needs of the planning area experiencing exceedances. This approach allows the pursuit of a commonsense strategy for the High Desert. Considering the similar nature of PM_{10} emissions arising from the nonattainment area it is most appropriate to develop a uniform control strategy. Thus the following list of controls will be widespread in scope and broadly implemented throughout the nonattainment area.

If new information from particulate matter studies or monitoring becomes available, or changes to the PM10 standard occur, the MDAQMD commits to evaluate and make appropriate recommendations for revisions to the plan and any subsequent rules.

<u>Construction and Demolition:</u>
This control measure is intended to reduce emissions from construction and demolition activities such as: groundbreaking, grading, excavation, loading, crushing, cutting, planning, stockpiling, and

unnecessary denuding of the natural vegetation. Construction projects should be managed to minimize dust emissions. Large projects should prepare a Dust Control Plan detailing what operational and phasing measures will be taken to minimize dust emissions.

Control Measures (including RACM):

- Use water for short-term surface stabilization
- Minimize trackout onto paved roads
- Cover haul trucks
- Stabilize (chemical or vegetation) site upon completion of grading when subsequent development is delayed
- Rapid cleanup of project-related trackout or spills on paved roads
- Minimize grading and soil movement when winds exceed 30 miles per hour
- Require a Dust Control Plan (DCP) for construction/demolition projects disturbing 100 or more acres, to address the following additional measures:

    Provide paved or stabilized access to construction site as soon as is feasible
    Maintain natural topography to the extent possible
    Construct parking lots and paved roads first, where feasible
    Construct upwind portions of projects first, where feasible

Control Source:

Construction/demolition activities that disturb at least 1/2 acre.

Control Requirement:

All applicable construction/demolition projects shall employ all feasible control measures. Large project DCP's shall provide for control of fugitive dust emissions employing all feasible control measures. No visible emissions shall migrate away from project and cross property boundary lines; nor shall established opacity limits be exceeded.

Emission Reductions:

Eighty percent reduction in construction emissions.

Estimated Cost:

Administrative costs associated with DCP preparation; water truck operation; design change costs; project scheduling costs; trackout and spill cleanup; haul truck covers; stabilization and vegetating costs. Total impact on a typical construction project is estimated at $200 per acre. (USEPA "Control of Open Fugitive Dust Sources")

Potential Funding:

Affected parties (owners/operators)

Estimated Cost Effectiveness:

Control of example 10 acre residential construction project is estimated to generate 34 tons of PM_{10} emission reductions and cost $2000, for a cost effectiveness of $60 per ton.

Implementation:

Fully implemented by December 31, 1996.

Enforcement:

- City/County Ordinances
- MDAQMD Rule(s); Site Inspection

Stabilization of Public Unpaved Roads

The emissions generated from driving on public unpaved roads can be significant considering the number of vehicle trips. This control measure would provide for a reduction in emissions by stabilizing (including but not limited to paving) some of the more heavily traveled unpaved public roadways.

Control Measures (including RACM):

Require stabilization (including but not limited to paving and chemical stabilization) of certain unpaved public roadways.

Control Source:

Heavily traveled unpaved roads under the jurisdiction of and maintained by incorporated cities and towns, and the County.

Control Requirement:

Identify the specific unpaved public roads that need to be stabilized according to the established criteria.

Emission Reductions:

At least 3.65 miles of publicly maintained unpaved road shall be stabilized. Stabilizing roads will reduce unpaved road dust entrainment emissions by at least 1514 tons per year, and unpaved road wind erosion by at least 27 tons per year.

Estimated Cost:

$250,000 to $300,000 per mile for paving costs (July 26, 1995, San Bernardino County Transportation/Flood Control Department). $7,000 to $35,000 per mile for annual maintenance.

Potential Funding:

City/County Funding

Estimated Cost Effectiveness:

Stabilizing of the specified roads is anticipated to generate 1541 tons of PM_{10} emission reductions and cost $912,500 to $1,095,000 initially and $26,000 to $128,000 per year for twenty years, for an estimated cost effectiveness of $46 to $119 per ton.

Implementation:

All affected roads must be stabilized by January 1, 1998.

Enforcement:

- Place Control Measure as a priority project in the Regional Transportation Improvement Plan (RTIP)
- Site inspection

<u>Minimize City and County Disturbed Area (Weed Suppression):</u>

Disking, scraping and other clearing methods to suppress weeds for aesthetics or fire prevention can generate significant amounts of dust, first through the clearing action itself, and second by disturbing and exposing the cleared area to wind erosion. Mowing weeds as an alternative to clearing minimizes the fire hazard, does not disturb the soil surface, retains the root base, and leaves a minimal vegetation wind break. This measure will eliminate weed suppression as a source of disturbed area by requiring mowing of weeds instead of clearing.

Control Measures (including RACM):

- Prohibition on clearing or plowing techniques for weed suppression
- Use of mowing for weed suppression

Control Source:

City and County Disturbed Areas

Control Requirement:

Use of mowing for all volunteer and required weed suppression

Emission Reductions:

Eighty percent reduction in City and County disturbed areas emissions.

Estimated Cost:

Mowing is estimated to cost $200 per acre for equipment rental or hire.

Potential Funding:

Affected parties (land owners)

Estimated Cost Effectiveness:

Mowing instead of clearing one acre is expected to reduce PM_{10} emissions by 0.6 tons and cost $200, for an estimated cost effectiveness of $270 per ton of PM_{10} reduced.

Implementation:

Clearing or plowing techniques for weed suppression will not be allowed after June 30, 1996.

Enforcement:

- City/County Ordinance
- MDAQMD Rule/Site inspection

Bureau of Land Management Fugitive Dust Control Plan:

The BLM must develop a Dust Control Plan (DCP) which includes specific actions that will be taken prior to January 1998. A draft Dust Control Plan should be prepared and submitted to the MDAQMD by June 30, 1996; a final DCP meeting MDAQMD approval, must be submitted by December 31, 1996. The final approved DCP will be forwarded to USEPA for inclusion into the SIP.

Control Measures (including RACM):

- Stipulate that all new authorizations for stationary emission sources obtain all necessary MDAQMD permits and satisfy all applicable SIP provisions, including project or activity-specific RACM
- Closure of certain roads and routes as per recent Wilderness classification in the California Desert Protection Act
- Closure of certain roads and routes identified through general BLM planning
- Implementation of PM_{10} reduction measures contained in El Mirage Cooperative Management Area Plan, Stoddard Valley OHV Area Management Plan, and the Johnson Valley OHV Area Management Plan
- Harden the interface between major non-surfaced OHV access roads and paved roads where feasible
- Apply dust control measures to major non-surfaced access roads where feasible
- Apply dust control measures to major OHV open area parking/staging areas where feasible
- Use standard road design and drainage specifications when maintaining existing roads or authorizing maintenance and new construction
- Include public educational information on PM10 emissions with open area literature and on kiosks/signs in heavily used areas

Control Source:

Lands and activities under BLM jurisdiction

Control Requirement:

Adherence to a Dust Control Plan containing certain specific control measures

Emission Reductions:
Not quantified

Estimated Cost:
Not quantified

Potential Funding:
Park User Fees

Estimated Cost Effectiveness:
Not quantified

Implementation:
Measures in DCP must be fully implemented by December 31, 1997.

Enforcement:

- BLM
- MDAQMD

Lucerne Valley Region

Since the large PM_{10} exceedance measured in Lucerne Valley has been determined to be significantly impacted by calcium and calcium carbonate sources, those sources in the Lucerne Valley region must implement a fugitive dust control strategy in order to bring the region into attainment. The affected Lucerne Valley sources have already implemented the majority of the measures identified. The MDAQMD will render these control measures federally enforceable through rule adoption or other means.

<u>Fugitive Dust Controls for Stationary Sources:</u>
This control strategy is intended to reduce incidental emissions resulting from industrial operations within the Lucerne Valley, such as emissions from wind erosion of disturbed industrial areas, industrial unpaved road travel emissions, wind erosion of storage piles, material losses from process lines, deposits of materials on paved roadways and material track-in from unpaved areas.

Control Measures (including RACM):

- Stabilize Heavily Traveled Haul Roads
- Enclose Process Lines
- Lower Bulk Material Storage Piles
- Cover Bulk Material Haul Trucks While Operating on Public Paved Roads
- Moisture Spray at Transfer Points

- Stabilize Long-term Storage Piles
- Stabilize or Pave Operations Areas
- Vacuum Sweep Product Spills
- Prevention or Rapid Clean-up of Material Track-Out onto Paved Roads
- Minimize Transfer Line Spillage

Control Sources:
- Lucerne Valley Limestone Processing Plants
- Lucerne Valley Limestone Mining Operations
- Lucerne Valley Cement Manufacturing

Control Requirement:

Implementation of above RACM sufficient to reduce certain Lucerne Valley industrial fugitive dust source PM_{10} emissions by 65% from 1990 levels.

Emission Reductions:

65 percent control on the affected sources will generate 509 tons per year of emission reductions.

Estimated Cost:

Process line enclosures; haul truck covers; moisture spray equipment; sweeper rental/purchase; paving costs, chemical stabilizers, operational changes. Typical cost is expected to be industrial haul road chemical stabilization, at $50,000 per year for 15 miles.

Potential Funding:

Affected Sources (Owners/Operators)

Estimated Cost Effectiveness:

Chemical stabilization of 15 miles of heavily traveled industrial haul roads generates 171 tons per year of emission reductions at an annual cost of $50,000, for an estimated cost effectiveness of $237 per ton reduced.

Implementation:

This control strategy must be implemented by December 31, 1997.

Enforcement:
- MDAQMD Rule/ Site Inspection
- Notice of Violation

Implementation Schedule

As stated in Chapter 2, the federal laws require implementation of Reasonably Available Control Measures within four (4) years of the nonattainment area's redesignation. This means the above control measure must be approved and implemented completely, prior to January 20, 1998. Since the planned PM_{10} reduction strategy includes a mix of control measures of varying complexity, the schedule for implementation must be realistic and yet meet statutory deadlines. The MDAQMD is sensitive to the potential costs and difficulty that the affected communities and facilities might encounter. To this end, the following implementation schedule is being proposed and the MDAQMD is soliciting public comment. Appropriate changes that are necessary, will be included in the final draft plan. Table 4-1 lists the various control measures for the MDPA and the target dates for implementation.

Table 4-1. Control Measure Implementation Schedule

Control Measure	Target Date
BLM Dust Control Plan	June 30, 1996
City and County Disturbed Areas	June 30, 1996
Construction/Demolition Controls	Dec. 31, 1996
Stationary Source Fugitive Dust Controls	Dec. 31, 1997
Stabilization of Selected Streets	Jan. 1, 1998

CHAPTER 5: ATTAINMENT DEMONSTRATION

Emission Reductions

Projected PM_{10} Concentrations

Contingency Measures

Emission Reductions

The MDAQMD has identified several reasonably available control measures for implementation within the Mojave Desert Planning Area. Adoption of these measures by the MDAQMD will make the reductions already achieved enforceable. Please refer to Chapter 4 for a detailed discussion of each control measure. The control measures are summarized in Table 5-1.

Projected PM_{10} Concentrations

Table 5-2 presents the projected controlled emission inventory and maximum 24-hour concentration for the planning area during 1998, the future milestone year, and 2000, the attainment year. Table 5-3 presents the projected controlled emission inventory and maximum 24-hour concentration for the Lucerne Valley region during 1998, the future milestone year, and 2000, the attainment year. Milestone and attainment year contributions are calculated by applying the ratio of the given year's emissions (relative to the design day emissions) to the design day contribution for each source category. The identified control measures, as implemented by the end of 1998, bring the planning area (and the Lucerne Valley region) into attainment of the NAAQS for PM_{10} under worst case wind and construction activity conditions similar to those experienced during the late 1980's and early 1990's.

Contingency Measures

The MDAQMD's comprehensive fugitive dust rule will include additional actions to be taken if the identified emission reductions are not achieved, or if an exceedance of either PM_{10} NAAQS is registered after full implementation of the identified control measures.

As a contingency measure, certain lengths of unpaved road will be stabilized sufficient to generate at least 2267 tpy of PM_{10} emission reductions. Candidates for stabilization include roads or portions of roads carrying 800 trips or more per day. This represents a minimum of two miles of unpaved roadway with 1,800,000 annual VMT. Paving of these two miles of unpaved road would generate 2267 tpy of PM_{10} emission reductions. Other less effective stabilization methods could require treatment of more unpaved roads.

Table 5-1. Control Measure Summary

Emission Reductions (Attainment Year - 2000)

Control Measure	Mojave Desert Planning Area (tpy)	Lucerne Valley Region (tpy)
Construction and Demolition	6845	56
City and County Disturbed Areas	4731	98
Stabilization of Unpaved Roads	1541	236
Industrial Fugitive Controls		509
Total Emission Reductions (tpy):	13117	899

Table 5-2. MDPA Attainment Demonstration by Source Category
Milestone and Attainment 24-Hour Concentrations

Mojave Desert Planning Area

	Uncontrolled (yr 1998)			Milestone (yr 1998)		Attainment (yr 2000)	
	Inventory	**24-Hour**		**Inventory**	**24-Hour**	**Inventory**	**24-Hour**
	(tpy)	(ug/m^3)	(%)	(tpy)	(ug/m^3)	(tpy)	(ug/m^3)
Background		3.0	1		3.0		3.0
Transport		3.5	1		3.5		3.5
BLM Land Activity	17369	8.4	4	17369	8.4	18888	9.1
Stationary (Industrial) Sources	2744	1.3	1	2744	1.3	2829	1.4
Miscellaneous Area Sources	1766	0.9	0	1766	0.9	1850	0.9
Mobile Source Exhaust and Tire Wear	1059	0.5	0	1059	0.5	1003	0.5
National Park and Forest Activity	1106	0.5	0	1106	0.5	1106	0.5
Fugitive Dust Sources:							
City and County Unpaved Road Travel	29113	14.0	6	27366	13.2	22270	10.7
Paved Road Dust Entrainment	10203	4.9	2	10203	4.9	10732	5.2
Windblown Fugitive Dust Sources:							
City and County Unpaved Road Wind Erosion	8741	68.2	29	8479	66.1	7658	59.7
City and County Disturbed Areas	5914	46.1	19	1183	9.2	1183	9.2
BLM Unpaved Road Wind Erosion	2476	19.3	8	2476	19.3	2476	19.3
Construction	8556	66.7	28	1711	13.3	1711	13.3
National Park and Forest Wind Erosion	111	0.9	0	111	0.9	111	0.9
Totals:	89158	238.3		75573	145.1	71817	137.3

Table 5-3. LV Attainment Demonstration by Source Category

Milestone and Attainment 24-Hour Concentration

Lucerne Valley Region

	Uncontrolled (yr 1998)			Milestone (yr 1998)		Attainment (yr 2000)	
	Inventory	**24-Hour**		**Inventory**	**24-Hour**	**Inventory**	**24-Hour**
	(tpy)	(ug/m^3)	(%)	(tpy)	(ug/m^3)	(tpy)	(ug/m^3)
Background		3.0	1		3.0		3.0
Transport		2.5	1		2.5		2.5
Mobile Source Exhaust and Tire Wear	16	0.1	0	16	0.1	15	0.1
Miscellaneous Area Sources	45	0.2	0	45	0.2	47	0.2
Fugitive Dust Sources:							
City and County Unpaved Road Travel	4466	21.8	7	4243	20.7	4222	20.6
Paved Road Dust Entrainment	150	0.7	0	150	0.7	158	0.8
Windblown Fugitive Dust Sources:							
Construction	70	20.6	7	14	4.1	14	4.1
City and County Unpaved Road Wind Erosion	1369	36.4	12	1355	36.0	1353	36.0
Stationary (Industrial) Sources	783	228.0	72	274	79.8	274	79.8
City and County Disturbed Areas	122	3.2	1	24	0.6	24	0.6
Totals:	7021	316.5		6121	147.8	6107	147.7

CHAPTER 6: CONFORMITY EMISSION BUDGETS

General

The FCAA requires transportation plans, programs, and projects, as well as general federal actions, to conform to the SIP. The General Preamble to the FCAA suggests that emission budgets be clearly established in federal nonattainment area plans to ensure that emissions generated by federal actions (including transportation plans, programs and projects) do not inhibit progress towards attainment of the NAAQS in a federal nonattainment areas.

Fugitive dust is the primary cause of PM_{10} violations in the PM_{10} nonattainment area. PM_{10} precursors are an insignificant contributor to the MDAQMD's PM_{10} problem. As a result, the MDAQMD is not including PM_{10} precursor emissions, such as VOC and NO_x, in the PM_{10} emission inventory.

Transportation Conformity Emission Budgets

PM_{10} emissions generated by on-road entrained dust and on-road exhaust and tire wear emissions constitute seven percent of the PM_{10} emission inventory. On-road mobile sources are not a significant contributor to PM_{10} violations in the nonattainment area. The MDAQMD's PM_{10} problem is a localized problem caused by desert soils, not automobile tailpipe emissions. The District will propose to ARB and USEPA that the MPO is not required to apply the federal transportation conformity requirements to transportation plans, programs or projects within the PM_{10} nonattainment area. Hot-spot analysis identifies whether the project in question could cause or contribute to any new PM_{10} violations, or increases the frequency or severity of any existing PM_{10} violations.

General Federal Actions Conformity Emission Budgets

PM_{10} violations in the PM_{10} nonattainment area are a localized problem caused by disturbed desert soils. As a result, the MDAQMD is not including a specific emission budget for general federal actions. Federal agencies are only required to conduct a project-specific PM_{10} analysis to satisfy the federal conformity requirements. Project-specific analysis will entail comparison of direct and indirect emissions resulting from the general federal action to de minimis thresholds (currently 100 tons of PM_{10}). Projects generating more than one hundred tons will be required to demonstrate compliance will all relevant portions of the plan.

APPENDIX A: AIR QUALITY AND METEOROLOGICAL DATA

Air Monitoring Stations

Air Monitoring Network Review

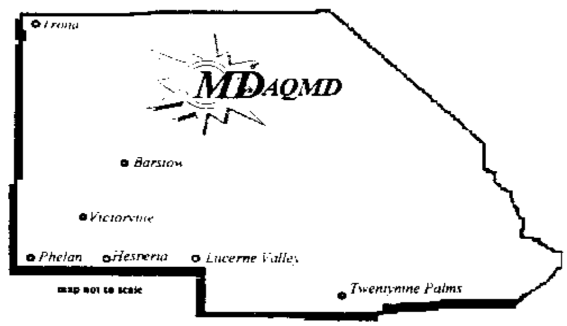
Particulate Matter Data

Wind Data

CARB Identification of Exceptional Events

Military PM_{10} Monitoring Commitments

Air Monitoring Stations



1. Barstow: This site has been at the present location since May 1, 1980.

   Hesperia: This site has been at the present location since January 2, 1986.

   Lucerne Valley: This site has been at the present location since June 1, 1989.

   Twentynine Palms: From May 1, 1980, to June 2, 1993, the site was located at 6078 Adobe Road next to the County library. This was the location of the PM_{10} exceedances. Due to dirt road traffic around the library and the growth of trees adjacent to the tower the site was moved on June 2, 1993, to a location about 130 meters to the southwest. This location is on an asphalt parking lot and offers no obstructions to the station.

   Victorville: From May 1980 to March 1986 the site was located at the County fairgrounds. On January 1, 1986, the TSP sampler was moved to a location on Eighth Street. The TSP sampler was removed and a PM_{10} sampler was relocated at the fairgrounds on June 1, 1990. Due to increased traffic, a nearby motorcycle race track, weekend swap meets, the County fair, and other activities around the station, the site was relocated in April 1991 to its present location on Amargosa Road.

2. All PM_{10} samplers are the Sierra Anderson Model 321 with a 1200 SSI head.

3. The present sites at Barstow, Lucerne Valley and Hesperia have not been changed since the exceedances. The Twentynine Palms exceedances occurred at the Adobe Road site. The Victorville exceedances occurred at the fairgrounds site.

Significant PM_{10} Sources at Station Sites

Barstow: County Sheriff helicopter pad 20 meters north of the site.

Hesperia: The only known sources are general development activities associated with the strong growth in the High Desert, such as the new Post Office, which was built about one block west of the site.

Twentynine Palms: Increased traffic on dirt roads at the old location due to County library activities.

Lucerne Valley: There are several mining and batch plant activities west and southwest of the site. The site is on a middle school property near trash containers on a dirt area.

Victorville: Fairground activity, an open swap meet on weekends, increased traffic due to the activities at the motorcycle speedway on Saturdays, the County fair in July and August, a cement tank truck operation to the north, and the dirt area around the station itself with little or no ground cover.

Monitor Quality Assurance

The MDAQMD Air Quality Surveillance Sections Quality Assurance program is operated in accordance with the CARB Quality Assurance Plan (Volume II). All requirements in the CARB Plan area followed. In addition, CARB conducts annual site audits.

All PM_{10} samplers are overhauled and calibrated semi-annually. The motors are replaced every six months or whenever a motor fails. Replacement of the motor requires a complete calibration. A record of equipment calibration frequency is kept in the station log book. Records indicate that all samplers were within calibration specifications during the exceedance periods.

There were no malfunctions of samplers at the Barstow, Victorville and Twentynine Palms sites. Equipment malfunction resulted in invalidation of data during the following periods:

Hesperia:	1990:	January 16 through February 11
	1991:	February 11 through May 30
		July 28 through July 29
Lucerne Valley:	1991:	November 20 through November 29
		December 8 through December 31
	1992:	January 1 through February 2

Air Monitoring Network Review

USEPA Network Review of Stations

USEPA conducts a SLAMS Network Review on an annual basis.

Preliminary Proposal for Changes to the Network

In a conversation between Bob Ramirez, MDAQMD Supervising Air Quality Technician, and Rob Rothacker of CARB, the issue of additional PM_{10} monitoring was addressed. CARB indicated that the MDAQMD Air Monitoring Network was presently being reviewed by CARB. It was suggested that the results of this review would be forwarded to the MDAQMD by April 1995. Preliminary information indicates that the following is being proposed by CARB:

- A station should be designated as a "National Ambient Monitoring Station (NAMS)" site in the urban area of Hesperia, Victorville and Apple Valley. No additional monitoring will be required, as redesignation of one of the existing Hesperia or Victorville sites from "State and Local Air Monitoring Station (SLAMS)" to NAMS will meet the requirement.

- Additional monitoring in the eastern region of the MDAQMD, specifically in the Needles and Blythe areas.

- A Dichot sampler with a 2.5 micron cutpoint should be installed at the Hesperia site and further ion analysis to address other components not identifiable on the quartz filter medium.

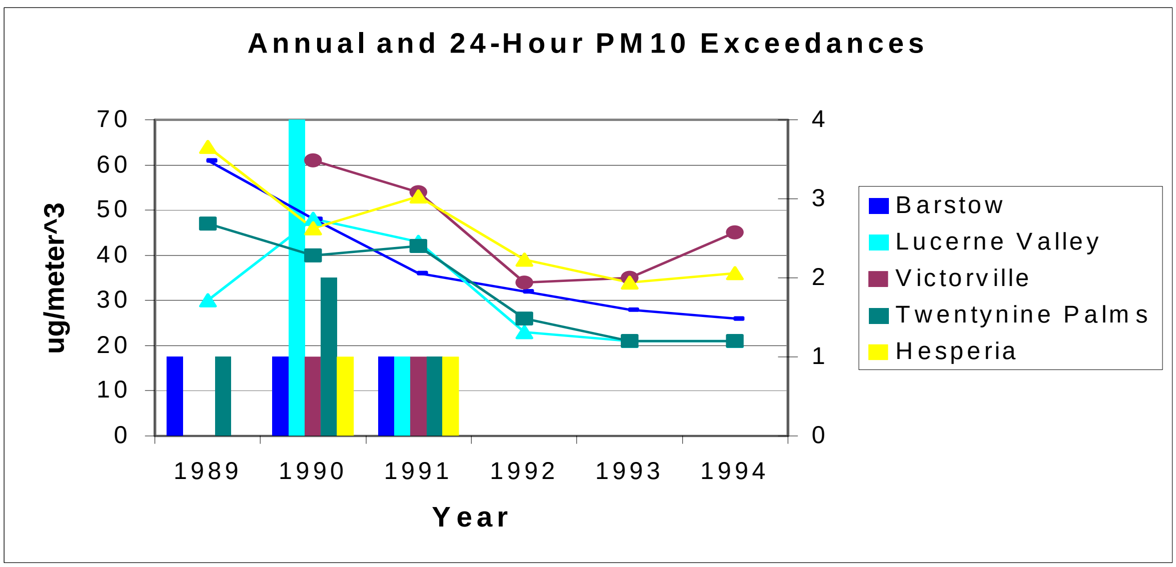
- A Tapered Element Oscillating Microbalance (TEOM) real time PM_{10} monitor be installed in the Victorville, Hesperia and Apple Valley area (preferably Hesperia) to measure PM_{10} levels on an hourly basis.

Exceedance and Exceedance Day Data Summary

MDAQMD PM10 Ambient Data (1989-1994)

Federal Exceedances	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Barstow	1	1	1	0	0	0
Lucerne Valley	0	4	1	0	0	0
Victorville		1	1	0	0	0
Twentynine Palms	1	2	1	0	0	0
Hesperia	0	1	1	0	0	0
Annual Averages						
Barstow	**61**	48	36	32	28	26
Lucerne Valley	30	48	43	23	21	21
Victorville		**61**	**54**	34	35	45
Twentynine Palms	47	40	42	26	21	21
Hesperia	**64**	46	**53**	39	34	36

Exceedance Days	**Date**	**ug/m^3**	**Media**	**Crustal**	**Other**
Barstow	12/19/90	381	quartz	81%	wind event
Barstow	5/30/91	197	quartz	96%	wind event
Barstow	10/13/89	191	quartz	35%?	
Hesperia	2/17/91	320	quartz	91%	wind event
Hesperia	11/1/90	171	quartz	84%	
Lucerne Valley	2/17/91	389	quartz	83%	wind event
Lucerne Valley	2/16/90	317	quartz	12%	Ca/CaCO3
Lucerne Valley	5/23/90	313	quartz	13%	Ca/CaCO3
Lucerne Valley	11/1/90	195	quartz	91%	
Lucerne Valley	12/19/90	187	quartz	43%	wind event
Twentynine Palms	12/19/90	297	quartz	82%	wind event
Twentynine Palms	2/17/91	297	quartz	84%	wind event
Twentynine Palms	11/13/90	286	glass	?	?
Twentynine Palms	7/9/89	155	?	?	?
Victorville	2/17/91	439	quartz	79%	wind event
Victorville	11/19/90	181	glass	?	?



Regional PM_{10} Concentrations on MDAQMD Exceedance Days

All values are 24-Hour PM10 in micrograms per cubic meter

Monitor	**7/9/89**	**10/13/89**	**2/16/90**	**4/23/90**	**5/23/90**	**11/1/90**
Lone Pine	13	14	52	13	27	28
Coso Junction	52	25	11	**866**	22	11
China Lake	---	16	65	---	28	12
Mojave Airport	---	41	24	**462**	83	92
Lancaster	59	51	---	81	42	**342**
Banning	43	**182**	21	13	41	25
Palm Springs	**163**	94	41	48	41	31
Indio	**378**	116	76	108	99	53
Trona	---	89	102	**366**	43	---
Barstow	---	**191**	64	---	---	47
Victorville	---	---	---	---	---	---
Hesperia	---	51	59	30	27	---
Lucerne Valley	25	44	**317**	27	**313**	**195**
Twentynine Palms	**155**	32	38	26	39	145

Monitor	**11/13/90**	**11/19/90**	**12/19/90**	**2/17/91**	**5/30/91**
Lone Pine	12	21	25	28	---
Coso Junction	14	23	12	26	64
China Lake	16	31	---	---	**534**
Mojave Airport	21	34	20	---	51
Lancaster	69	43	27	**780**	68
Banning	34	40	17	69	33
Palm Springs	31	27	74	98	**197**
Indio	59	57	**278**	**189**	**340**
Trona	89	31	147	40	---
Barstow	38	---	**381**	71	**197**
Victorville	---	**181**	48	**439**	---
Hesperia	40	37	79	**320**	57
Lucerne Valley	38	43	**187**	**389**	74
Twentynine Palms	**286**	45	**297**	**297**	98

Exceedance Day Chemical Analyses

All values in micrograms per cubic meter

			Analytes			% of 24-Hour			Location Annual Arithmetic Means			
Location	Date	24-Hour	Sulfate	Nitrate	Chloride	Sulfate	Nitrate	Chloride	PM10	Sulfate	Nitrate	Chloride
1989										(percent of annual)		
29 Palms	7/7/89	155								(incomplete data)		
Barstow	10/13/89	191	2.9	3.8	0.07	2%	2%	0.04%		(incomplete data)		
1990												
29 Palms	11/1/90	145	4.1	1.8	1.71	3%	1%	1.18%	40	1.7	1.8	0.16
	11/13/90	286	2.1	2.5	1.24	1%	1%	0.43%		4%	4%	0.40%
	11/19/90	45	1.1	2.4	0.00	2%	5%	0.00%				
29 Palms	12/13/90	32	2.1	5.1	0.32	7%	16%	1.00%	40	1.7	1.8	0.16
	12/19/90	297	1.7	7.4	0.69	1%	2%	0.23%		4%	4%	0.40%
	12/25/90	21	0.9	0.9	0.16	4%	4%	0.76%				
Barstow	12/13/90	42	2.5	9.1	0.00	6%	22%	0.00%	48	2.3	2.6	0.65
	12/19/90	381	2.3	6.5	0.42	1%	2%	0.11%		5%	5%	1.35%
	12/25/90	76	1.3	1.4	0.04	2%	2%	0.05%				
Hesperia	10/26/60	74	1.4	1.9	0.80	2%	3%	1.08%	47	2.6	2.9	0.12
	11/1/90	171	1.4	3.1	0.34	1%	2%	0.20%		6%	6%	0.26%
	11/6/20	49	1.0	0.9	0.07	2%	2%	0.14%				
Lucerne V	2/10/90	11	0.6	0.9	0.06	5%	8%	0.55%	48	1.8	2.2	0.09
	2/16/90	317	2.2	6.6	0.19	1%	2%	0.06%		4%	5%	0.19%
	2/22/90	82	0.6	0.8	0.05	1%	1%	0.06%				
Lucerne V	5/17/90	36	2.2	2.0	0.21	6%	6%	0.58%	48	1.8	2.2	0.09
	5/23/90	313	1.8	3.4	0.08	1%	1%	0.03%		4%	5%	0.19%
	6/4/90	35	2.5	1.4	0.03	7%	4%	0.09%				
Lucerne V	10/26/90	42	1.0	1.3	0.04	2%	3%	0.10%	48	1.8	2.2	0.09
	11/1/90	195	1.8	3.1	0.42	1%	2%	0.22%		4%	5%	0.19%
	11/7/90	21	1.3	0.9	0.08	6%	4%	0.38%				
Lucerne V	12/13/90	31	1.9	4.4	0.00	6%	14%	0.00%	48	1.8	2.2	0.09
	12/19/90	187	2.3	7.6	0.42	1%	4%	0.22%		4%	5%	0.19%
	12/25/90	33	1.1	1.5	0.16	3%	5%	0.48%				
Trona	4/17/90	8	1.5	1.2	0.48	19%	15%	6.00%	48	3.7	2.2	1.08
	4/23/90	366	16.0	1.8	3.05	4%	0%	0.83%		8%	5%	2.24%
	4/29/90	64	2.8	1.4	0.83	4%	2%	1.30%				
Victorville FG	11/14/90	55	4.2	12.0	1.84	8%	22%	3.35%	61	3.2	3.4	0.58
	11/19/90	181	2.3	3.8	1.81	1%	2%	1.00%		5%	6%	0.96%
	11/25/90	79	3.1	13.0	1.91	4%	16%	2.42%				
1991												
29 Palms	2/11/91	28	1.9	1.4	0.23	7%	5%	0.82%	42	1.8	2.3	0.19
	2/17/91	297	1.8	3.8	38.00	1%	1%	12.79%		4%	5%	0.46%
	2/23/91	26	1.1	3.4	0.07	4%	13%	0.27%				
Barstow	5/24/91	39	3.7	3.5	0.07	9%	9%	0.18%	36	2.4	3.0	0.13
	5/30/91	197	2.7	3.8	0.46	1%	2%	0.23%		7%	8%	0.36%
	6/11/91	26	2.4	2.9	0.09	9%	11%	0.35%				
Lucerne V	2/11/91	20	1.9	1.3	0.09	10%	7%	0.45%	43	2.0	2.8	0.17
	2/17/91	389	1.8	4.4	0.25	0%	1%	0.06%		5%	6%	0.39%
	2/23/91	22	1.3	2.0	0.05	6%	9%	0.23%				
Hesperia	2/11/91	60	2.1	2.8	0.18	4%	5%	0.30%	53	2.8	3.8	0.11
	2/17/91	320	2.9	5.4	0.41	1%	2%	0.13%		5%	7%	0.21%
	2/23/91	63	2.2	8.0	0.06	3%	13%	0.10%				
Victorville FG	2/11/91	59	2.3	4.0	0.18	4%	7%	0.31%	54	3.2	4.4	0.17
	2/17/91	439	2.5	5.0	0.45	1%	1%	0.10%		6%	8%	0.32%
	2/23/91	51	2.4	10.0	0.24	5%	20%	0.47%				

July 8-9, 1989 Winds

Date	Barstow			Trona			29 Palms			Hesperia			Victorville-CV			Phelan		
	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
7/8/89 0:00	6	---	WSW	2	6	NW	1	---	W	10	---	WSW	8	---	W	8	---	S
7/8/89 1:00	4	---	W	5	7	NW	3	---	WNW	8	---	WSW	6	---	WSW	7	---	S
7/8/89 2:00	3	---	W	4	9	NW	4	---	WNW	7	---	SW	4	---	WSW	8	---	S
7/8/89 3:00	4	---	W	2	7	WNW	5	---	WNW	7	---	SW	2	---	SE	7	---	S
7/8/89 4:00	2	---	WSW	2	6	NNW	3	---	NNE	5	---	SW	2	---	SE	7	---	S
7/8/89 5:00	2	---	WSW	4	6	NNW	4	---	W	5	---	SW	3	---	SSE	5	---	SSW
7/8/89 6:00	1	---	WSW	1	5	NNW	5	---	NW	4	---	SSW	3	---	SE	2	---	S
7/8/89 7:00	4	---	W	1	4	S	3	---	NNW	4	---	S	4	---	SE	4	---	ESE
7/8/89 8:00	7	---	W	1	3	SW	7	---	NNW	3	---	E	3	---	SSE	6	---	ESE
7/8/89 9:00	8	---	W	0	4	NE	3	---	N	3	---	ESE	3	---	SE	5	---	ESE
7/8/89 10:00	7	---	WSW	1	5	S	3	---	E	3	---	S	2	---	ESE	8	---	SE
7/8/89 11:00	7	---	WSW	1	7	S	6	---	ESE	13	---	SSW	5	---	W	8	---	SE
7/8/89 12:00	7	---	WSW	2	7	WSW	10	---	W	16	---	SSW	12	---	WSW	11	---	SSE
7/8/89 13:00	8	---	W	4	14	SSW	13	---	W	16	---	SSW	11	---	WSW	13	---	SE
7/8/89 14:00	9	---	W	8	12	SSE	17	---	WSW	15	---	SSW	12	---	SW	15	---	SSE
7/8/89 15:00	11	---	W	9	15	SSW	17	---	W	15	---	SSW	13	---	SW	17	---	SSE
7/8/89 16:00	15	---	SW	14	17	SW	18	---	W	15	---	SSW	11	---	SW	13	---	SE
7/8/89 17:00	14	---	WSW	12	15	SW	19	---	WSW	14	---	SSW	11	---	WSW	9	---	SSE
7/8/89 18:00	15	---	SW	9	12	SW	14	---	W	12	---	SSW	12	---	WSW	8	---	S
7/8/89 19:00	17	---	SW	3	10	S	11	---	W	11	---	SSW	11	---	WSW	7	---	S
7/8/89 20:00	14	---	SW	10	15	SSE	12	---	NNW	10	---	SW	10	---	WSW	5	---	SSW
7/8/89 21:00	14	---	SW	7	13	SSE	9	---	NW	9	---	SW	10	---	WSW	6	---	WSW
7/8/89 22:00	13	---	SW	2	6	W	9	---	NW	10	---	SW	10	---	WSW	7	---	WSW
7/8/89 23:00	14	---	SW	1	4	WNW	6	---	NW	9	---	SW	10	---	WSW	7	---	W
7/9/89 0:00	11	---	SW	2	5	WNW	6	---	SSW	10	---	SW	8	---	WSW	9	---	W
7/9/89 1:00	6	---	W	6	8	NW	13	---	SSW	9	---	SW	8	---	WSW	9	---	W
7/9/89 2:00	2	---	NE	5	8	WNW	3	---	ENE	6	---	SW	5	---	SW	5	---	SW
7/9/89 3:00	3	---	E	3	8	NW	2	---	ESE	9	---	WSW	8	---	WSW	16	---	SSE
7/9/89 4:00	7	---	SW	4	12	SSW	1	---	NNW	10	---	SW	10	---	WSW	10	---	SSE
7/9/89 5:00	4	---	W	5	12	SSW	1	---	SW	11	---	SW	11	---	WSW	12	---	SSE
7/9/89 6:00	8	---	WSW	7	10	S	2	---	ESE	13	---	SSW	12	---	WSW	13	---	SSE
7/9/89 7:00	6	---	WSW	2	4	SW	3	---	E	12	---	SSW	14	---	WSW	13	---	SE
7/9/89 8:00	9	---	SW	1	4	SSW	2	---	NE	16	---	SSW	13	---	WSW	15	---	SSE
7/9/89 9:00	10	---	SW	1	5	WNW	2	---	ENE	18	---	SSW	15	---	WSW	16	---	SSE
7/9/89 10:00	10	---	WSW	2	6	WNW	5	---	E	15	---	SSW	16	---	WSW	17	---	SE
7/9/89 11:00	10	---	W	2	9	WSW	5	---	ESE	15	---	S	15	---	WSW	19	---	SE
7/9/89 12:00	14	---	SW	4	9	SSW	4	---	W	16	---	SSW	12	---	SW	20	---	SE
7/9/89 13:00	13	---	WSW	5	17	S	12	---	W	16	---	SSW	13	---	SW	20	---	SE
7/9/89 14:00	14	---	SW	16	21	SW	13	---	W	16	---	SSW	13	---	SW	22	---	SE
7/9/89 15:00	14	---	SW	16	22	WSW	15	---	W	16	---	SSW	13	---	SW	22	---	SE
7/9/89 16:00	15	---	SW	19	23	SW	17	---	W	15	---	SSW	14	---	SW	20	---	SE
7/9/89 17:00	17	---	SW	21	24	SW	18	---	WSW	14	---	SSW	12	---	SW	16	---	SE
7/9/89 18:00	13	---	SW	18	23	SW	18	---	W	14	---	SSW	10	---	WSW	13	---	SSE
7/9/89 19:00	12	---	WSW	17	23	SW	16	---	W	10	---	SSW	12	---	WSW	12	---	SSE
7/9/89 20:00	11	---	SW	10	17	SW	11	---	W	4	---	WSW	10	---	WSW	11	---	SSE
7/9/89 21:00	9	---	SW	7	13	SW	3	---	ESE	9	---	WSW	10	---	WSW	9	---	S
7/9/89 22:00	9	---	WSW	7	11	S	2	---	NW	10	---	SW	11	---	WSW	12	---	SSE
7/9/89 23:00	6	---	WSW	10	14	SSE	7	---	NW	10	---	WSW	11	---	WSW	12	---	SSE

October 12-13, 1989 Winds

	Barstow			Trona			29 Palms			Hesperia			Victorville-CV			Phelan		
Date	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
10/12/89 0:00	6	7	SW	3	4	N	2	5	NW	2	5	NNW	4	5	WSW	7	---	SSW
10/12/89 1:00	5	6	WSW	3	5	N	1	4	W	4	7	WSW	4	5	W	8	---	SSW
10/12/89 2:00	5	6	WSW	3	5	N	3	6	WNW	4	7	SSW	2	3	SSE	9	---	SSW
10/12/89 3:00	3	5	WSW	1	3	WSW	3	5	NNW	5	6	SW	1	2	S	8	---	SSW
10/12/89 4:00	2	3	WSW	0	3	NNE	0	5	W	4	5	SW	2	3	S	8	---	SSW
10/12/89 5:00	4	7	SW	1	3	N	1	4	NNW	5	6	SSW	2	3	S	9	---	SSW
10/12/89 6:00	4	7	WSW	0	3	W	1	4	W	4	6	SW	2	3	SSE	7	---	SSW
10/12/89 7:00	3	4	W	0	1	SW	2	3	NE	3	5	S	3	4	ESE	2	---	ESE
10/12/89 8:00	4	5	W	0	1	SE	1	3	ESE	4	6	SSE	5	5	SE	5	---	ENE
10/12/89 9:00	5	6	WSW	1	3	ESE	2	3	ENE	3	5	ESE	5	5	SE	5	---	ENE
10/12/89 10:00	5	6	W	1	4	S	2	3	NE	4	7	ENE	4	6	SE	6	---	E
10/12/89 11:00	4	6	W	1	3	S	1	4	ESE	5	24	NNE	4	7	ESE	0	---	ENE
10/12/89 12:00	4	6	WNW	1	4	N	2	6	E	3	8	ESE	4	7	ESE	5	---	NE
10/12/89 13:00	2	6	ENE	0	5	ENE	4	6	ESE	6	11	SSW	4	8	ESE	10	---	WNW
10/12/89 14:00	5	7	ESE	0	5	S	5	7	ESE	8	11	SSW	5	7	SSW	7	---	WNW
10/12/89 15:00	5	7	ESE	1	3	W	5	8	E	8	11	SSW	7	9	SSW	6	---	NW
10/12/89 16:00	4	5	ESE	1	7	ESE	4	5	SSW	6	10	S	7	9	S	6	---	WNW
10/12/89 17:00	3	5	SE	6	13	SSE	2	5	SSW	5	7	S	5	6	SSW	3	---	WSW
10/12/89 18:00	4	6	SSE	6	9	SSE	2	4	ENE	7	9	SSW	7	10	SW	6	---	SSW
10/12/89 19:00	2	5	S	0	2	W	2	5	N	6	9	WSW	6	9	WSW	8	---	SSW
10/12/89 20:00	4	6	WSW	1	3	NNE	1	5	N	4	5	SW	5	5	WSW	8	---	S
10/12/89 21:00	6	8	SW	2	4	N	2	4	W	3	4	S	3	4	SW	9	---	SSW
10/12/89 22:00	4	8	WSW	2	4	N	2	4	NW	5	7	SW	1	2	ESE	9	---	SSW
10/12/89 23:00	4	5	WSW	2	5	N	2	4	NW	4	7	SSW	2	3	SE	9	---	SSW
10/13/89 0:00	4	5	WSW	0	3	WSW	2	4	NW	1	4	SSW	2	4	SSW	9	---	SSW
10/13/89 1:00	5	6	WSW	1	3	WSW	3	5	WNW	3	4	WSW	1	2	S	8	---	SSW
10/13/89 2:00	5	5	WSW	1	4	NNE	3	5	NW	5	6	WSW	4	5	SW	8	---	SSW
10/13/89 3:00	4	5	SW	0	2	WNW	3	5	WNW	3	4	SW	3	4	SE	7	---	SSW
10/13/89 4:00	4	5	WSW	1	4	N	2	4	NW	4	6	WSW	2	3	S	6	---	S
10/13/89 5:00	2	5	WSW	1	3	WSW	1	4	W	3	4	S	3	4	SE	7	---	SSW
10/13/89 6:00	3	4	WSW	0	2	SSW	1	2	N	3	5	SW	3	4	SSE	8	---	SSW
10/13/89 7:00	4	7	WSW	0	2	NE	0	2	E	3	4	SSW	3	4	SE	4	---	SSW
10/13/89 8:00	3	5	WSW	0	2	E	1	4	N	2	4	S	3	3	ESE	3	---	NNE
10/13/89 9:00	5	6	W	0	2	SSE	1	3	E	2	3	ENE	3	4	ESE	5	---	NNE
10/13/89 10:00	4	6	WSW	1	3	S	3	4	NE	3	4	ENE	3	4	ESE	6	---	NE
10/13/89 11:00	5	6	W	0	3	SW	1	4	E	4	6	ENE	2	5	ESE	6	---	NE
10/13/89 12:00	5	6	W	1	4	ENE	2	4	SE	3	5	E	4	5	ESE	10	---	E
10/13/89 13:00	3	5	W	1	5	N	1	4	W	7	11	SSW	4	7	SSE	9	---	ESE
10/13/89 14:00	1	3	W	0	5	E	3	5	ENE	8	11	SSW	7	8	SSW	11	---	SE
10/13/89 15:00	3	5	E	2	12	WNW	1	4	E	8	11	S	7	9	SSW	13	---	SE
10/13/89 16:00	4	5	E	7	14	S	4	8	SW	7	10	S	7	9	S	11	---	SSE
10/13/89 17:00	4	5	SE	10	14	SSE	5	7	SW	5	8	SSW	7	8	S	9	---	S
10/13/89 18:00	4	6	SSE	4	7	S	8	10	SW	5	6	S	5	8	SSW	10	---	SSE
10/13/89 19:00	1	4	WSW	3	5	SW	2	5	E	5	8	SSW	5	6	W	9	---	S
10/13/89 20:00	4	8	W	2	4	SW	4	7	NNE	5	7	SSW	5	6	WSW	8	---	S
10/13/89 21:00	5	8	WSW	2	6	NW	2	6	NNW	7	10	SSW	6	7	SSW	8	---	SSW
10/13/89 22:00	5	7	W	1	4	N	4	6	WNW	7	9	SSW	6	7	SW	7	---	SSW
10/13/89 23:00	7	8	WSW	3	5	N	2	5	NW	5	7	SW	7	8	W	7	---	S

February 15-16, 1990 Winds

	Barstow			Trona			29 Palms			Hesperia			Victorville-CV			Phelan		
Date	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**
2/15/90 0:00	6	7	---	0	1	E	10	12	NNW	2	5	ENE	2	5	W	7	9	SSW
2/15/90 1:00	1	5	---	0	2	NNE	11	14	NNW	2	5	ESE	1	4	N	7	8	SSW
2/15/90 2:00	4	5	---	0	0	E	10	12	NW	1	2	SSE	3	6	NE	6	8	SSW
2/15/90 3:00	4	6	---	1	6	NE	9	13	NNW	1	4	SSW	2	4	ENE	4	6	SSW
2/15/90 4:00	5	7	---	0	3	NNW	4	9	NNE	3	4	SW	2	3	ESE	4	6	SSW
2/15/90 5:00	5	6	---	0	4	NNW	6	8	N	3	4	SSW	1	3	ESE	6	7	SSW
2/15/90 6:00	4	6	---	0	0	W	6	7	NW	3	4	SW	2	4	E	6	7	SSW
2/15/90 7:00	3	5	---	0	0	W	6	7	NW	2	4	SSW	1	4	NNE	3	5	ESE
2/15/90 8:00	5	7	---	0	2	NW	6	7	NNW	2	4	SE	3	6	N	3	6	ENE
2/15/90 9:00	5	6	---	0	2	W	7	10	N	2	5	NW	1	4	WNW	3	7	ENE
2/15/90 10:00	4	5	---	0	2	SE	6	8	N	1	5	WSW	1	4	WSW	4	8	E
2/15/90 11:00	4	6	---	1	4	SSE	5	8	N	2	10	WNW	3	10	S	4	9	ENE
2/15/90 12:00	6	10	---	2	5	SE	5	8	N	5	10	NW	5	11	SSW	3	7	NE
2/15/90 13:00	6	9	---	2	7	SE	2	6	NE	5	10	NNW	7	12	SW	5	8	WNW
2/15/90 14:00	6	8	---	4	8	SE	3	6	NNE	2	10	WNW	5	13	SSW	5	10	WNW
2/15/90 15:00	4	7	---	3	5	SE	1	5	NNE	6	11	S	6	12	SSW	5	11	NW
2/15/90 16:00	5	---	---	3	7	ESE	1	4	NE	8	11	SSW	5	14	ESE	9	12	WNW
2/15/90 17:00	3	---	---	0	3	ESE	2	3	SE	7	10	SSW	9	14	ESE	9	13	WSW
2/15/90 18:00	1	---	---	0	0	E	2	3	SSW	8	12	SSW	9	12	ESE	9	13	SSW
2/15/90 19:00	2	---	---	0	4	NNE	1	3	NW	8	11	SSW	10	15	ESE	7	11	SSW
2/15/90 20:00	3	---	---	0	1	E	1	4	NE	8	11	SW	13	17	SE	8	10	S
2/15/90 21:00	3	---	---	0	4	E	2	5	NNW	9	11	SSW	14	17	SE	8	11	SSW
2/15/90 22:00	3	---	---	0	1	N	3	4	WNW	9	12	SSW	10	16	ESE	10	13	SSW
2/15/90 23:00	4	---	---	2	5	NNE	2	5	NW	8	11	SSW	10	13	ESE	10	13	SSW
2/16/90 0:00	3	---	---	2	5	NNE	2	3	WNW	8	11	SSW	10	13	ESE	11	12	SSW
2/16/90 1:00	3	---	---	0	5	NE	2	4	WNW	8	10	SSW	12	17	ESE	12	15	SSW
2/16/90 2:00	3	---	---	0	3	NNE	3	5	NW	9	11	SSW	11	16	ESE	14	17	SSW
2/16/90 3:00	4	---	---	0	1	E	2	3	NW	9	11	SSW	10	14	ESE	15	18	SSW
2/16/90 4:00	3	---	---	0	1	NNE	1	5	NW	7	10	SSW	10	13	ESE	12	16	S
2/16/90 5:00	3	---	---	0	2	NNE	4	6	NW	4	9	SSW	3	8	E	13	15	SSW
2/16/90 6:00	5	---	---	1	4	NNE	2	5	NW	7	13	SSW	5	8	ENE	13	15	SSW
2/16/90 7:00	4	---	---	1	5	NE	1	3	WSW	9	13	SSW	5	7	ENE	13	16	SSW
2/16/90 8:00	3	4	---	0	1	NE	1	3	NW	6	12	SSW	5	9	NNE	11	16	NNE
2/16/90 9:00	2	4	---	1	4	E	2	3	NE	15	23	SSW	12	19	E	12	17	NNE
2/16/90 10:00	3	5	---	15	21	S	1	4	NE	18	26	SSW	17	25	E	15	21	NE
2/16/90 11:00	3	5	---	16	22	SSW	1	4	NWN	12	23	SSW	18	25	ENE	16	25	NE
2/16/90 12:00	5	7	---	22	28	SSW	4	5	NNE	21	28	SSW	21	29	ENE	19	24	E
2/16/90 13:00	13	19	---	19	27	SSW	4	7	NE	17	24	SSW	20	29	NE	18	24	ESE
2/16/90 14:00	19	22	---	20	26	SW	1	8	ENE	16	22	SSW	18	27	NNE	18	23	SE
2/16/90 15:00	22	24	---	22	29	SSW	10	15	WSW	17	22	SSW	22	33	NE	17	23	SE
2/16/90 16:00	21	23	---	25	32	SSW	7	15	SW	14	22	SSW	21	28	NNE	17	23	SSE
2/16/90 17:00	19	21	---	20	26	SSW	7	9	SSW	11	15	S	21	30	NNE	11	18	S
2/16/90 18:00	21	24	---	23	33	SSW	6	10	SSW	12	18	SSW	21	31	NNE	11	18	SSE
2/16/90 19:00	21	25	---	20	28	SSW	4	11	SSW	12	18	SSW	21	29	NNE	11	19	S
2/16/90 20:00	20	23	---	13	27	SSW	2	14	WNW	14	20	SSW	20	29	N	17	24	S
2/16/90 21:00	16	19	---	21	30	SSW	8	13	WSW	12	19	SSW	18	26	N	18	28	SSW
2/16/90 22:00	21	23	---	12	17	S	11	16	W	12	20	SSW	17	21	N	19	27	SSW
2/16/90 23:00	20	22	---	14	18	SSW	12	19	WSW	13	19	SSW	14	19	NNW	15	21	S

May 22-23, 1990 Winds

	Barstow			Trona			29 Palms			Hesperia			Victorville-CV			Phelan		
Date	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
5/22/90 0:00	---	---	---	16	22	SW	8	13	NNW	8	11	SW	8	14	SSW	3	6	W
5/22/90 1:00	---	---	---	13	22	SW	3	6	NW	7	9	W	6	10	SSW	4	6	S
5/22/90 2:00	---	---	---	3	11	SSW	8	10	NW	6	8	WSW	5	9	S	6	7	S
5/22/90 3:00	---	---	---	4	7	SSE	4	6	NNW	6	7	WSW	4	7	SSW	6	7	S
5/22/90 4:00	---	---	---	1	7	NNE	3	5	NW	6	8	WSW	4	6	SW	6	8	SSW
5/22/90 5:00	---	---	---	1	7	N	4	6	NW	4	7	WSW	2	7	SSW	5	7	S
5/22/90 6:00	---	---	---	4	7	N	4	6	NNW	1	4	NNE	2	4	E	2	7	W
5/22/90 7:00	---	---	---	2	7	N	2	5	WNW	1	4	NW	2	10	SW	2	7	NNE
5/22/90 8:00	---	---	---	1	5	SSW	1	4	N	4	8	SSW	5	10	SSW	2	8	NNE
5/22/90 9:00	---	---	---	1	5	SW	5	7	N	6	8	SSW	6	12	SSW	3	9	NW
5/22/90 10:00	---	---	---	1	7	S	4	8	NNE	8	13	SSW	6	16	SSW	2	9	N
5/22/90 11:00	---	---	---	2	7	SSW	4	9	N	9	14	SW	5	12	S	0	12	ESE
5/22/90 12:00	---	---	---	2	9	SW	4	8	NNE	6	11	SSW	3	16	SSE	3	20	ESE
5/22/90 13:00	---	---	---	13	19	SSW	0	7	S	9	14	SSW	5	20	SSE	7	19	SW
5/22/90 14:00	---	---	---	16	21	SSW	3	12	N	11	17	SSW	12	19	SSE	13	21	W
5/22/90 15:00	---	---	---	18	23	SW	8	13	WNW	13	18	SSW	10	24	S	11	19	WSW
5/22/90 16:00	---	---	---	18	23	SW	11	14	W	13	18	SSW	11	19	S	13	19	WSW
5/22/90 17:00	---	---	---	13	17	SW	12	14	WNW	12	17	SSW	10	17	S	9	19	WSW
5/22/90 18:00	---	---	---	13	17	WSW	11	13	WNW	11	16	SSW	13	18	S	10	14	SSE
5/22/90 19:00	---	---	---	13	15	WSW	11	13	NW	12	15	SSW	15	21	S	12	16	SSE
5/22/90 20:00	---	---	---	12	15	SW	10	13	WNW	13	16	SSW	14	18	S	11	15	SSE
5/22/90 21:00	---	---	---	12	15	SSW	10	12	NW	10	14	SSW	11	15	SSE	7	9	SSE
5/22/90 22:00	---	---	---	9	12	SW	8	9	NW	9	12	SSW	10	14	S	7	13	S
5/22/90 23:00	---	---	---	11	15	SW	2	7	NW	8	10	SSW	4	10	SSW	6	11	SSE
5/23/90 0:00	---	---	---	12	16	SW	1	5	N	8	11	SSW	5	8	W	9	12	S
5/23/90 1:00	---	---	---	6	14	S	2	5	WNW	10	13	SSW	6	10	WSW	9	15	S
5/23/90 2:00	---	---	---	7	9	ESE	4	7	N	12	15	SSW	4	10	SSE	10	15	SSE
5/23/90 3:00	---	---	---	5	7	SE	1	4	N	11	15	SSW	10	14	SE	8	12	S
5/23/90 4:00	---	---	---	6	9	SSE	0	3	W	11	14	SSW	10	13	SSE	8	11	S
5/23/90 5:00	---	---	---	2	8	S	0	2	WNW	9	13	S	12	17	SSE	9	15	SSE
5/23/90 6:00	---	---	---	5	12	SSE	0	3	NW	10	13	S	14	19	SSE	11	14	SSE
5/23/90 7:00	---	---	---	11	16	S	2	4	NNE	11	14	S	15	21	SSE	10	13	SSE
5/23/90 8:00	---	---	---	16	20	SSW	3	5	NE	11	14	S	---	---	---	7	14	SE
5/23/90 9:00	---	---	---	15	20	SSW	3	5	SE	12	16	S	---	---	---	8	13	SE
5/23/90 10:00	---	---	---	18	23	SSW	4	8	ESE	12	18	SSW	---	---	---	6	11	ESE
5/23/90 11:00	---	---	---	19	28	SSW	1	12	E	13	18	S	---	---	---	6	16	SE
5/23/90 12:00	---	---	---	19	26	SSW	13	18	W	14	19	S	---	---	---	9	24	SSE
5/23/90 13:00	---	---	---	22	27	S	12	16	WSW	15	21	SSW	---	---	---	18	25	S
5/23/90 14:00	---	---	---	21	26	SSW	13	16	WNW	17	22	SSW	---	---	---	15	22	S
5/23/90 15:00	---	---	---	22	27	SSW	13	16	W	17	23	SSW	---	---	---	12	20	SSW
5/23/90 16:00	---	---	---	22	30	SSW	15	17	WNW	16	20	SSW	---	---	---	10	21	SSW
5/23/90 17:00	---	---	---	25	30	SSW	14	17	W	16	20	SSW	---	---	---	7	17	WSW
5/23/90 18:00	---	---	---	20	25	SSW	15	17	WNW	14	21	SSW	---	---	---	7	12	W
5/23/90 19:00	---	---	---	18	22	SW	13	17	WNW	10	15	S	---	---	---	7	15	SW
5/23/90 20:00	---	---	---	19	23	SW	12	15	WNW	12	17	SSE	---	---	---	8	12	SSE
5/23/90 21:00	---	---	---	17	21	SW	18	22	WNW	13	21	S	---	---	---	8	13	SSE
5/23/90 22:00	---	---	---	17	21	SW	20	24	WNW	10	18	SSW	---	---	---	1	9	SE
5/23/90 23:00	---	---	---	15	20	SW	10	19	NW	8	13	W	---	---	---	14	20	W

October 31-November 1, 1990 Winds

	Barstow			Trona			Victorville-FG			29 Palms			Hesperia			Phelan		
Date	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
10/31/90 0:00	---	---	---	2	4	NNE	1	4	WNW	2	5	W	6	8	S	2	10	SSW
10/31/90 1:00	5	9	WSW	1	3	ENE	4	7	S	6	11	N	5	12	SSW	10	17	SSE
10/31/90 2:00	6	9	WSW	2	3	NE	5	10	S	6	8	NNW	9	13	SSW	5	12	S
10/31/90 3:00	4	7	WSW	3	5	NE	5	9	SSW	1	5	NNW	9	13	SSW	1	11	WNW
10/31/90 4:00	4	7	WSW	1	3	NE	2	5	S	1	4	NW	7	10	SSW	2	10	WNW
10/31/90 5:00	5	7	WSW	2	4	NNE	1	5	W	1	4	NW	9	13	SSW	6	16	S
10/31/90 6:00	6	8	WSW	3	5	NE	7	12	S	1	4	WNW	11	15	SSW	6	18	S
10/31/90 7:00	5	6	SW	3	5	NE	8	12	S	1	3	WNW	12	16	SSW	2	15	S
10/31/90 8:00	4	6	WSW	4	5	NE	8	14	S	2	5	WSW	13	17	S	3	9	NNE
10/31/90 9:00	4	6	WSW	2	4	NE	11	17	S	2	4	SSE	11	16	S	4	19	WSW
10/31/90 10:00	7	14	WSW	2	20	SW	12	19	S	5	6	E	13	22	SSW	13	22	SSW
10/31/90 11:00	9	14	WSW	16	21	SSW	17	25	SSE	8	22	WNW	15	21	SSW	14	21	S
10/31/90 12:00	13	20	SSW	17	22	SW	17	24	SSE	15	18	W	16	20	SSW	14	19	SE
10/31/90 13:00	15	21	SSW	18	23	SW	16	25	SSE	16	19	WNW	15	22	SSW	11	16	SSE
10/31/90 14:00	15	21	SSW	17	24	SW	15	25	SSE	16	20	W	16	21	SSW	11	16	SSE
10/31/90 15:00	11	18	WSW	17	20	SW	14	20	SSE	15	19	W	15	20	SSW	11	17	SSE
10/31/90 16:00	10	17	WSW	19	23	WSW	12	19	S	12	17	W	14	19	SSW	13	18	SSE
10/31/90 17:00	9	15	W	20	24	WSW	11	19	SSW	11	12	WNW	10	14	SSW	2	13	ESE
10/31/90 18:00	10	14	WSW	14	20	SW	5	7	SW	11	13	WNW	11	14	WSW	2	6	WSW
10/31/90 19:00	10	13	WSW	15	20	SW	5	8	SW	2	8	NNW	9	14	WSW	3	7	SE
10/31/90 20:00	11	15	SW	13	18	SW	2	6	SSW	1	7	WNW	10	16	SW	3	6	SSE
10/31/90 21:00	11	16	SW	13	18	SW	6	12	SSW	5	9	NNW	11	14	SSW	2	6	S
10/31/90 22:00	13	18	SW	14	18	SW	6	14	SW	6	9	NW	9	15	S	1	6	NNW
10/31/90 23:00	10	15	SW	15	18	SW	10	17	SSW	3	10	NNW	9	13	SSW	1	7	SW
11/1/90 0:00	13	18	SW	16	19	WSW	9	16	SSW	1	5	S	8	13	S	3	7	S
11/1/90 1:00	12	17	WSW	18	23	WSW	3	8	SW	1	4	WSW	7	12	SSW	2	7	S
11/1/90 2:00	10	14	WSW	13	17	SW	3	8	SSW	2	5	WNW	9	13	SSW	3	7	SE
11/1/90 3:00	10	---	---	11	14	SW	5	11	SW	4	7	NW	7	12	SSW	2	5	S
11/1/90 4:00	11	16	SW	8	11	SW	7	12	WSW	5	7	N	5	7	WSW	5	9	W
11/1/90 5:00	11	16	SW	5	11	SSW	9	12	SW	1	6	NNW	7	10	W	5	9	W
11/1/90 6:00	12	17	SW	3	6	NE	10	15	WSW	1	3	NW	10	13	W	2	4	SW
11/1/90 7:00	11	16	SW	7	9	NNE	12	17	W	5	9	NNW	11	15	WNW	4	9	WNW
11/1/90 8:00	14	19	SW	8	9	NNE	12	17	W	6	10	N	12	16	W	4	8	WNW
11/1/90 9:00	14	20	SW	5	8	NE	15	19	W	7	10	N	9	14	SW	8	12	WNW
11/1/90 10:00	13	17	SW	2	5	E	14	20	W	7	9	N	9	14	SW	12	17	WNW
11/1/90 11:00	11	17	W	1	6	E	15	24	W	7	10	N	10	15	SW	12	17	WNW
11/1/90 12:00	12	19	WSW	1	7	ENE	14	20	WNW	9	12	NW	9	14	SSW	12	17	WNW
11/1/90 13:00	11	18	W	1	6	ENE	14	23	WNW	8	12	N	10	17	W	13	16	WNW
11/1/90 14:00	11	18	W	9	18	SW	14	19	NW	9	11	N	14	17	WNW	16	20	W
11/1/90 15:00	11	17	WSW	13	18	SW	14	21	NW	7	9	NNE	15	20	WNW	18	22	W
11/1/90 16:00	13	19	WSW	1	17	ENE	16	24	NNW	7	12	N	16	22	WNW	18	21	W
11/1/90 17:00	10	16	WSW	13	15	NE	14	21	NNW	12	15	N	16	23	WNW	12	19	W
11/1/90 18:00	11	16	WSW	11	14	NE	12	18	NNW	10	13	NW	16	21	WNW	11	16	WNW
11/1/90 19:00	9	15	SW	5	11	E	10	14	NW	12	16	WNW	13	17	WNW	13	18	W
11/1/90 20:00	9	13	SW	6	11	SW	12	16	NW	13	16	NW	10	15	W	10	14	WSW
11/1/90 21:00	10	14	SW	7	9	SW	9	14	NW	7	8	N	8	11	WNW	12	17	W
11/1/90 22:00	8	17	WSW	5	8	NNE	8	13	NNW	6	12	NNW	9	12	WNW	12	15	W
11/1/90 23:00	9	14	SW	0	4	E	9	15	N	9	13	NNW	9	13	NW	11	15	W

November 12-13, 1990 Winds

	Barstow			Trona			Victorville-FG			29 Palms			Hesperia			Phelan		
Date	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
11/12/90 0:00	2	5	SW	2	3	NE	3	5	SSE	2	6	NNW	3	5	SW	5	7	S
11/12/90 1:00	1	4	SW	1	4	W	2	5	SSE	1	4	NW	4	6	SSW	6	8	S
11/12/90 2:00	3	6	WSW	2	4	WSW	2	4	SSE	3	5	WNW	5	6	SSW	7	9	SSW
11/12/90 3:00	3	6	WSW	2	4	NNE	2	7	W	2	5	NW	4	7	WSW	7	8	SSW
11/12/90 4:00	4	6	WSW	1	3	W	1	5	SE	0	3	NNE	3	5	SW	7	9	SSW
11/12/90 5:00	4	6	WSW	1	2	SW	2	4	SE	2	5	WNW	3	5	SW	7	9	SSW
11/12/90 6:00	3	5	W	1	3	NE	3	7	SSE	2	4	NW	2	5	SW	5	8	SSW
11/12/90 7:00	3	5	W	0	3	SW	3	5	SSE	1	4	ENE	3	6	WSW	4	6	S
11/12/90 8:00	4	5	W	1	5	E	2	3	SE	2	4	NNE	0	2	SE	1	3	E
11/12/90 9:00	4	8	W	2	6	ENE	1	3	ESE	1	4	N	1	12	NNW	3	5	NNE
11/12/90 10:00	4	6	W	1	2	ESE	2	4	ESE	4	5	NE	3	5	NE	4	7	NE
11/12/90 11:00	4	5	ESE	1	2	ESE	1	4	ESE	4	5	NE	3	6	ENE	4	7	NNE
11/12/90 12:00	4	9	E	1	3	ENE	2	7	NE	2	4	E	3	7	NNE	3	7	NNE
11/12/90 13:00	7	10	ESE	1	2	E	4	8	N	4	5	ESE	4	7	NNE	4	8	NNE
11/12/90 14:00	7	10	E	0	2	SE	4	7	N	3	6	ESE	5	8	ENE	4	7	NNE
11/12/90 15:00	7	10	E	1	3	WSW	5	8	NNW	3	4	ESE	5	8	ENE	4	7	NNE
11/12/90 16:00	5	8	E	1	2	SW	5	6	NNW	3	3	E	4	6	NE	1	5	ENE
11/12/90 17:00	4	5	SE	1	3	W	3	5	WNW	2	4	NW	4	6	NNE	6	8	SSW
11/12/90 18:00	4	6	SE	2	4	NNE	2	4	SW	3	5	NW	3	6	N	7	8	SSW
11/12/90 19:00	4	6	SE	1	4	W	2	4	SSE	1	5	NW	2	4	S	7	8	SSW
11/12/90 20:00	3	5	SE	1	3	NNE	2	4	SSE	3	4	WNW	5	7	SSW	7	7	SSW
11/12/90 21:00	2	5	SW	2	4	NE	1	4	ESE	3	4	NW	4	6	SW	8	9	SSW
11/12/90 22:00	3	4	SW	2	3	NE	2	6	SSE	0	2	NNW	5	7	SSW	7	8	SSW
11/12/90 23:00	1	3	S	1	3	SW	4	6	SE	2	4	WNW	5	7	SSW	6	8	SSW
11/13/90 0:00	3	6	---	1	3	NE	---	---	---	3	5	WNW	4	7	SW	6	7	S
11/13/90 1:00	4	7	SW	2	3	NE	---	---	---	2	5	N	4	6	SW	7	8	SSW
11/13/90 2:00	3	5	WSW	2	4	NNE	---	---	---	2	5	NW	2	5	W	6	9	SSW
11/13/90 3:00	3	5	WSW	0	1	S	---	---	---	3	5	WNW	4	6	SSW	8	9	SSW
11/13/90 4:00	4	6	WSW	0	2	ENE	---	---	---	2	4	N	5	7	SSW	8	9	SSW
11/13/90 5:00	4	8	WSW	1	5	NNE	---	---	---	2	4	W	3	5	SSW	7	8	SSW
11/13/90 6:00	4	6	WSW	0	2	ENE	---	---	---	3	4	N	4	6	SSW	6	7	S
11/13/90 7:00	3	5	W	1	2	NE	---	---	---	1	3	SW	2	5	S	3	6	SSE
11/13/90 8:00	3	4	WNW	1	3	ESE	---	---	---	1	3	SE	2	4	NE	2	5	NE
11/13/90 9:00	5	8	W	2	4	ENE	---	---	---	2	3	E	2	8	N	4	8	N
11/13/90 10:00	5	9	W	2	3	E	---	---	---	2	5	ESE	4	6	NNE	3	8	NW
11/13/90 11:00	1	7	E	1	2	ENE	---	---	---	6	8	ESE	2	5	NE	3	5	NE
11/13/90 12:00	6	11	E	1	2	E	---	---	---	8	10	ESE	3	6	ENE	6	12	NE
11/13/90 13:00	7	10	ESE	1	2	ENE	---	---	---	8	9	SE	4	9	ENE	10	14	ESE
11/13/90 14:00	5	8	E	0	5	ESE	---	---	---	9	10	SE	3	8	E	6	14	W
11/13/90 15:00	3	5	ESE	3	5	SW	---	---	---	9	10	SE	8	12	SSW	8	11	WNW
11/13/90 16:00	2	4	SSE	3	5	W	---	---	---	5	8	SE	3	6	SW	1	7	WSW
11/13/90 17:00	0	2	SW	1	4	NW	---	---	---	3	6	SE	4	7	SSW	6	7	SSW
11/13/90 18:00	4	7	SE	0	3	NNW	---	---	---	1	4	W	4	5	S	6	9	S
11/13/90 19:00	4	7	SE	1	3	WNW	---	---	---	2	5	WSW	5	8	S	7	8	S
11/13/90 20:00	2	5	SE	1	3	NE	---	---	---	1	4	NNW	4	6	S	7	8	S
11/13/90 21:00	3	5	SW	0	3	WNW	---	---	---	1	4	N	4	6	S	6	8	SSW
11/13/90 22:00	2	5	SW	2	3	NE	---	---	---	2	5	NW	6	8	S	7	9	S
11/13/90 23:00	3	6	WSW	1	3	WSW	---	---	---	4	6	WNW	5	7	S	7	10	S

November 18-19, 1990 Winds

	Barstow			Trona			Victorville-FG			29 Palms			Hesperia			Phelan		
Date	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**
11/18/90 0:00	4	3	WSW	3	5	NE	3	5	E	2	5	WNW	4	9	SW	7	7	SSW
11/18/90 1:00	8	6	WSW	3	4	NE	5	7	ESE	4	6	WNW	8	10	WSW	7	8	S
11/18/90 2:00	7	5	WSW	3	4	NE	4	7	ESE	4	6	NW	7	9	SW	8	10	SSE
11/18/90 3:00	5	4	WSW	1	4	NE	3	5	ESE	2	4	NW	7	8	WSW	7	9	S
11/18/90 4:00	4	3	WSW	0	1	S	4	5	ESE	4	5	NW	4	8	SW	9	11	SSE
11/18/90 5:00	5	3	W	1	2	NE	2	5	E	2	4	W	7	8	WSW	7	10	S
11/18/90 6:00	5	3	W	2	3	NE	3	5	SE	3	5	WNW	3	7	SSW	6	8	SSW
11/18/90 7:00	4	3	WSW	2	4	NE	3	5	ESE	5	6	WNW	2	3	S	3	6	S
11/18/90 8:00	5	3	W	3	5	ENE	2	4	ESE	2	5	NNE	2	6	W	1	6	ENE
11/18/90 9:00	7	4	WNW	2	4	E	2	5	E	3	4	NE	3	5	ENE	2	7	ESE
11/18/90 10:00	7	4	WNW	1	3	ESE	3	5	NE	4	6	NNE	3	5	NNE	2	7	N
11/18/90 11:00	6	3	WNW	1	4	NNE	1	7	NW	2	4	NNE	1	5	NNW	3	7	N
11/18/90 12:00	10	5	WSW	2	4	ENE	1	10	W	2	5	E	5	12	SW	5	10	E
11/18/90 13:00	10	5	WSW	2	5	ENE	8	13	SW	3	5	E	10	13	SW	2	7	ESE
11/18/90 14:00	10	5	WSW	3	4	ENE	9	15	SSW	3	5	E	12	15	SW	8	13	SSE
11/18/90 15:00	11	5	W	4	5	NE	11	16	SSW	3	4	SE	11	14	SSW	12	14	SSE
11/18/90 16:00	8	3	WNW	5	7	N	10	16	S	1	3	E	9	14	SSW	10	13	SSE
11/18/90 17:00	12	7	SSW	2	6	N	9	13	S	2	4	NW	8	12	SSW	11	14	SSE
11/18/90 18:00	9	6	SW	2	4	WSW	6	9	S	3	5	NW	6	9	SW	10	16	SSE
11/18/90 19:00	7	4	W	1	3	NE	4	11	S	2	5	NW	7	10	SW	5	9	SSE
11/18/90 20:00	7	4	W	2	4	NE	3	8	SW	2	4	NNE	5	7	WSW	6	11	S
11/18/90 21:00	5	2	W	3	4	NE	4	9	SSW	2	5	WNW	5	7	WSW	7	9	S
11/18/90 22:00	4	2	SW	1	3	ENE	3	8	S	2	4	NW	3	7	SW	9	14	SSE
11/18/90 23:00	4	2	SSW	4	7	NE	3	6	E	1	3	N	7	11	SSW	10	14	SSE
11/19/90 0:00	5	3	WSW	4	6	NE	1	3	E	2	4	NNW	10	13	SSW	7	10	S
11/19/90 1:00	6	5	WSW	4	6	NE	1	3	SE	3	4	WNW	11	13	SSW	9	13	S
11/19/90 2:00	6	5	WSW	3	5	NE	4	6	S	1	3	NW	11	15	SW	12	14	SSE
11/19/90 3:00	7	5	WSW	3	5	NE	5	7	S	1	3	NNW	10	12	SW	9	13	S
11/19/90 4:00	6	5	WSW	4	6	NE	5	8	S	1	5	WNW	10	13	SW	9	13	S
11/19/90 5:00	9	6	WSW	4	6	NE	7	9	S	0	3	SSE	8	11	SW	10	15	SSE
11/19/90 6:00	10	8	WSW	3	4	NE	7	11	SSW	2	5	W	10	13	SW	13	16	SSE
11/19/90 7:00	9	6	W	0	2	ENE	4	8	WSW	2	5	WNW	8	13	SW	9	13	SSE
11/19/90 8:00	8	5	W	1	2	ESE	7	11	SW	2	3	ENE	11	17	SSW	9	13	SSE
11/19/90 9:00	8	5	W	1	2	E	8	14	SSW	1	3	ESE	13	21	SSW	10	16	SSE
11/19/90 10:00	6	4	W	0	2	E	11	19	S	2	4	ENE	10	14	SSW	9	15	SSE
11/19/90 11:00	9	6	W	0	2	E	14	20	S	2	3	E	12	16	S	9	14	SSE
11/19/90 12:00	14	7	WNW	1	6	NE	11	19	S	2	3	ESE	13	18	SSW	9	13	SSE
11/19/90 13:00	11	7	WNW	8	13	SW	8	12	SSW	2	3	ESE	11	15	SSW	9	14	SSE
11/19/90 14:00	10	5	WNW	11	14	SSW	10	15	SW	2	4	SE	12	16	SSW	10	14	SSE
11/19/90 15:00	9	6	WNW	11	14	SW	12	17	SSW	2	6	NNE	11	19	SSW	9	14	SSE
11/19/90 16:00	9	5	WNW	7	11	SSW	11	18	SSW	0	6	NNE	9	14	SSW	9	11	SSE
11/19/90 17:00	6	4	W	8	11	SW	8	13	SSW	6	9	NW	7	10	SW	7	10	S
11/19/90 18:00	9	5	W	12	14	SSW	11	19	SSW	3	6	WSW	11	16	SW	3	8	SSW
11/19/90 19:00	14	7	W	10	18	SW	12	21	S	2	4	SSE	6	12	SSW	4	8	E
11/19/90 20:00	8	5	W	9	14	SW	11	18	S	4	10	NW	4	8	SSW	3	6	S
11/19/90 21:00	12	7	WNW	7	14	SW	8	12	SSW	4	9	W	5	8	SW	3	6	SSW
11/19/90 22:00	10	5	WNW	6	17	SW	7	11	SSW	4	8	WNW	7	12	SW	6	11	NW
11/19/90 23:00	9	5	WNW	12	17	SW	6	11	WSW	5	8	NW	5	9	SW	6	9	NW

December 18-19, 1990 Winds

	Barstow			Trona			Victorville-FG			29 Palms			Hesperia			Phelan		
Date	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
12/18/90 0:00	46	3	WSW	1	3	NE	2	5	NW	1	4	SE	---	---	---	5	8	S
12/18/90 1:00	5	7	WSW	1	2	WSW	2	4	SE	1	6	WSW	---	---	---	6	9	SW
12/18/90 2:00	3	5	WSW	1	4	NE	2	4	SSW	3	5	W	---	---	---	6	8	SSW
12/18/90 3:00	3	7	WSW	1	4	WSW	3	5	SE	3	6	WNW	---	---	---	6	8	SSW
12/18/90 4:00	2	4	W	1	3	NE	2	5	ESE	1	5	NNW	---	---	---	5	7	SSW
12/18/90 5:00	4	7	WSW	1	3	NE	4	7	E	2	5	WSW	---	---	---	4	7	S
12/18/90 6:00	3	5	WSW	1	4	WSW	3	6	ESE	2	3	N	---	---	---	6	8	SSW
12/18/90 7:00	3	5	W	0	2	ESE	3	5	SE	1	5	W	---	---	---	5	7	SSW
12/18/90 8:00	4	7	W	1	2	ESE	4	5	ESE	2	3	ENE	---	---	---	2	6	S
12/18/90 9:00	5	6	WNW	0	2	ESE	4	7	E	1	3	SSE	---	---	---	10	17	WNW
12/18/90 10:00	4	7	W	2	3	ENE	3	6	E	2	4	ESE	---	---	---	13	16	WNW
12/18/90 11:00	6	9	WSW	2	4	E	8	19	W	2	4	E	---	---	---	16	21	WNW
12/18/90 12:00	5	8	WSW	0	4	ENE	13	18	WNW	2	5	E	---	---	---	18	23	W
12/18/90 13:00	6	17	WSW	1	3	ESE	13	18	WNW	3	5	E	---	---	---	18	23	W
12/18/90 14:00	14	20	WSW	3	4	E	13	19	W	3	5	ESE	---	---	---	17	21	W
12/18/90 15:00	17	25	WSW	1	3	ENE	11	17	SW	3	5	ESE	---	---	---	16	21	W
12/18/90 16:00	19	25	WSW	4	6	NE	10	15	SW	2	3	E	---	---	---	9	17	W
12/18/90 17:00	20	27	WSW	1	5	WNW	13	19	SW	2	6	NW	---	---	---	4	9	S
12/18/90 18:00	15	21	WSW	0	4	NNE	14	20	SW	1	6	NNW	---	---	---	3	8	SSW
12/18/90 19:00	15	21	WSW	1	5	NNW	10	16	SW	2	5	WNW	---	---	---	6	11	SSE
12/18/90 20:00	9	16	WSW	3	5	NE	13	17	SW	2	4	NNW	---	---	---	9	12	SSE
12/18/90 21:00	12	18	WSW	1	3	NNE	8	14	SSW	1	6	NW	---	---	---	12	14	SSE
12/18/90 22:00	12	20	WSW	1	5	NE	12	20	SSW	2	5	SW	---	---	---	11	15	SSE
12/18/90 23:00	10	16	WSW	1	6	NW	10	16	SSW	1	6	NW	---	---	---	12	15	SSE
12/19/90 0:00	---	---	---	14	19	WSW	8	14	SSW	3	6	WNW	---	---	---	13	17	SSE
12/19/90 1:00	---	---	---	18	21	SW	10	18	SSW	2	7	NNW	---	---	---	15	19	SSE
12/19/90 2:00	---	---	---	18	22	SSW	12	18	SSW	2	5	NW	---	---	---	11	15	SSE
12/19/90 3:00	---	---	---	11	17	S	17	25	SW	3	6	WNW	---	---	---	7	15	SSE
12/19/90 4:00	---	---	---	18	31	WSW	9	14	WSW	3	6	W	---	---	---	5	12	S
12/19/90 5:00	---	---	---	13	34	SSW	11	17	SSW	3	5	S	---	---	---	7	12	SSE
12/19/90 6:00	---	---	---	12	32	ENE	12	18	SW	1	7	NNW	---	---	---	6	10	S
12/19/90 7:00	---	---	---	16	23	SW	13	24	SSW	3	10	ESE	---	---	---	2	11	ESE
12/19/90 8:00	---	---	---	20	25	SW	15	22	SSW	1	6	ESE	---	---	---	5	13	ESE
12/19/90 9:00	---	---	---	20	24	SW	14	22	S	6	12	ESE	---	---	---	4	13	E
12/19/90 10:00	24	33	WSW	21	25	SW	15	22	SSW	4	24	WNW	---	---	---	5	11	NE
12/19/90 11:00	21	30	WSW	21	29	SW	9	22	SSW	20	30	WNW	---	---	---	9	18	SW
12/19/90 12:00	22	32	WSW	23	30	WSW	10	23	W	24	32	WNW	---	---	---	12	20	SSW
12/19/90 13:00	24	30	WSW	24	29	WSW	15	22	SSW	21	34	W	---	---	---	11	17	SW
12/19/90 14:00	22	29	WSW	19	25	WSW	12	24	SSW	29	40	WNW	---	---	---	10	16	SW
12/19/90 15:00	22	30	WSW	13	18	WSW	16	24	S	22	31	WNW	---	---	---	12	19	SW
12/19/90 16:00	25	33	WSW	13	19	SW	13	20	SSW	20	28	WNW	---	---	---	13	20	SW
12/19/90 17:00	20	26	WSW	15	21	SW	11	19	SSW	23	30	WNW	---	---	---	17	28	SSW
12/19/90 18:00	15	22	WSW	9	16	WSW	7	15	WSW	24	35	WNW	---	---	---	15	21	SSW
12/19/90 19:00	15	21	W	12	18	WSW	6	12	SW	24	32	WNW	---	---	---	12	20	SW
12/19/90 20:00	11	18	W	17	27	WSW	12	17	SW	22	33	WNW	---	---	---	11	15	SSW
12/19/90 21:00	10	15	W	14	23	WSW	9	17	WSW	23	35	WNW	---	---	---	10	19	SW
12/19/90 22:00	13	18	WSW	10	14	SW	9	17	WSW	21	31	WNW	---	---	---	10	21	SSW
12/19/90 23:00	13	19	WSW	11	14	SW	7	15	WSW	23	31	WNW	---	---	---	9	15	SW

February 16-17, 1991 Winds

	29 Palms			Barstow			Hesperia			Phelan			Trona			Victorville-FG		
Date	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**	**Spd**	**Peak**	**Dir**
2/16/91 0:00	2	11	W	5	9	WSW	8	---	SW	8	---	SSE	6	10	SSW	5	10	S
2/16/91 1:00	4	8	WSW	5	10	W	10	---	SW	5	---	SE	1	6	ENE	8	14	SSW
2/16/91 2:00	3	7	NW	4	9	W	12	---	SSW	8	---	ESE	1	6	E	10	15	SSW
2/16/91 3:00	7	9	NW	---	---	---	11	---	SSW	9	---	SE	3	5	NE	9	17	SSW
2/16/91 4:00	6	12	NW	3	6	W	15	---	SSW	8	---	SE	4	6	NE	11	16	SSW
2/16/91 5:00	6	9	NNW	5	8	WNW	12	---	SW	12	---	SSE	5	8	NE	11	18	SSW
2/16/91 6:00	2	9	NW	8	14	WSW	11	---	SW	9	---	SSE	4	6	NE	9	17	SSW
2/16/91 7:00	8	12	N	7	12	WSW	13	---	SW	13	---	SSE	6	8	NE	2	9	W
2/16/91 8:00	8	10	N	6	10	W	12	---	SSW	12	---	SSE	5	9	NE	9	15	SSW
2/16/91 9:00	8	10	NNW	14	21	WSW	11	---	WSW	3	---	W	4	5	ENE	13	19	SW
2/16/91 10:00	7	9	NNW	14	19	WSW	13	---	SW	11	---	SSE	8	17	WSW	13	18	SW
2/16/91 11:00	6	11	SW	13	19	W	16	---	SSW	11	---	SSE	14	19	WSW	12	19	SSW
2/16/91 12:00	2	7	S	14	21	WSW	19	---	SSW	12	---	SE	19	26	WSW	14	19	SSW
2/16/91 13:00	2	5	N	15	20	WSW	19	---	SSW	9	---	WNW	17	22	WSW	15	21	SSW
2/16/91 14:00	3	7	NNW	15	23	WSW	19	---	SSW	9	---	SE	16	19	WSW	13	20	S
2/16/91 15:00	5	17	NNW	15	22	WSW	18	---	SSW	4	---	S	16	19	WSW	13	18	S
2/16/91 16:00	12	18	NNW	16	24	WSW	16	---	SSW	9	---	W	13	19	WSW	12	18	SSW
2/16/91 17:00	10	14	NNW	17	22	WSW	14	---	SSW	5	---	SSW	11	15	WSW	10	15	SSW
2/16/91 18:00	10	14	NW	18	27	SW	13	---	SSW	4	---	SW	10	15	W	10	15	SSW
2/16/91 19:00	9	14	NW	19	25	SW	11	---	SW	16	---	W	3	10	NE	12	17	SW
2/16/91 20:00	10	13	NNW	18	25	SW	10	---	SW	20	---	WSW	4	9	NNE	12	19	WSW
2/16/91 21:00	8	11	NNW	20	25	SW	6	---	SSW	20	---	WSW	6	9	NNE	11	17	W
2/16/91 22:00	6	11	NNW	19	24	SW	6	---	SSW	16	---	WSW	6	8	NNE	12	17	W
2/16/91 23:00	7	10	NNW	17	23	WSW	7	---	SW	15	---	W	4	7	NE	9	18	WSW
2/17/91 0:00	7	16	NW	16	20	WSW	6	---	SW	17	---	W	1	4	NE	6	11	SSW
2/17/91 1:00	10	16	NW	15	19	WSW	6	---	WSW	13	---	W	2	5	NE	4	10	SW
2/17/91 2:00	11	16	NNW	15	19	SW	6	---	SW	14	---	WSW	4	7	NNE	5	12	SSW
2/17/91 3:00	14	20	NNW	17	22	SW	9	---	SW	13	---	W	4	7	NE	4	12	S
2/17/91 4:00	14	21	NNW	16	20	SW	6	---	SW	14	---	WSW	4	7	NNE	6	9	SW
2/17/91 5:00	11	18	NNW	16	21	SW	4	---	SSW	11	---	W	3	5	NE	7	12	W
2/17/91 6:00	12	16	NW	16	20	SW	6	---	SSW	14	---	W	2	4	NNE	5	9	W
2/17/91 7:00	9	14	NW	15	19	SW	3	---	S	13	---	W	2	4	NE	1	6	SE
2/17/91 8:00	9	16	WNW	16	22	WSW	3	---	W	17	---	WNW	1	5	ENE	12	21	WNW
2/17/91 9:00	19	24	WNW	14	22	WSW	14	---	NW	19	---	W	4	6	ENE	18	26	NW
2/17/91 10:00	20	24	NW	---	---	---	15	---	WNW	15	---	W	2	3	E	18	23	NW
2/17/91 11:00	19	23	NW	11	18	W	19	---	WNW	17	---	WNW	2	4	E	17	29	NW
2/17/91 12:00	17	23	NNW	12	18	W	16	---	NW	21	---	W	2	3	E	16	25	NW
2/17/91 13:00	17	20	NNW	10	17	W	16	---	NW	21	---	W	2	6	E	18	25	NW
2/17/91 14:00	18	23	NNW	11	18	W	20	---	WNW	21	---	W	1	8	NW	18	25	NW
2/17/91 15:00	18	23	NNW	12	17	W	21	---	WNW	20	---	W	8	10	E	17	22	NW
2/17/91 16:00	17	22	NNW	14	22	WSW	23	---	WNW	19	---	W	7	10	E	19	27	NW
2/17/91 17:00	18	25	NNW	12	18	SW	19	---	WNW	18	---	W	8	14	NNE	16	22	WNW
2/17/91 18:00	20	28	NNW	15	18	SSW	17	---	WNW	17	---	WSW	11	15	N	11	16	WNW
2/17/91 19:00	21	28	NW	12	19	SSW	15	---	WNW	19	---	WSW	6	9	NE	12	16	WNW
2/17/91 20:00	14	21	NW	8	14	SSW	14	---	WNW	14	---	W	1	4	ENE	9	20	NW
2/17/91 21:00	12	15	NW	5	11	SW	9	---	NW	8	---	WSW	6	12	NNE	5	8	WNW
2/17/91 22:00	10	19	NW	7	10	WSW	7	---	NW	7	---	WSW	6	10	NE	6	9	WNW
2/17/91 23:00	7	11	NNW	7	10	WSW	4	---	NW	11	---	WSW	7	10	NE	6	10	NW

May 29-30, 1991 Winds

	Barstow			Trona			29 Palms			Hesperia			Phelan			Victorville-AR		
Date	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir	Spd	Peak	Dir
5/29/91 0:00	2	5	WSW	1	7	S	8	12	WNW	5	8	SW	8	12	WSW	7	9	SSW
5/29/91 1:00	3	8	WSW	3	8	S	7	8	WNW	6	8	SSW	10	15	W	4	6	SSW
5/29/91 2:00	8	11	SW	3	7	SSW	6	8	WNW	6	8	SSW	9	11	SW	3	5	SSE
5/29/91 3:00	11	14	SSW	1	5	NNE	5	7	WNW	5	8	SW	9	13	SW	4	8	S
5/29/91 4:00	11	14	SSW	3	4	NE	5	7	WNW	5	7	SSW	9	13	SW	5	8	SW
5/29/91 5:00	11	14	SW	4	6	NE	4	8	WNW	5	7	SSW	5	10	SSW	2	5	SE
5/29/91 6:00	10	14	WSW	5	9	NE	4	8	W	4	6	SSW	1	3	SSE	2	7	SSE
5/29/91 7:00	13	18	SW	5	8	NE	6	9	NNW	3	6	SSW	4	8	SSE	6	11	WSW
5/29/91 8:00	12	17	WSW	2	5	ENE	4	8	N	3	7	SW	5	12	NW	5	10	W
5/29/91 9:00	11	16	WSW	2	5	SE	3	8	N	4	14	SSW	7	14	NW	7	12	WSW
5/29/91 10:00	11	16	WSW	3	6	SE	3	7	E	9	15	SSW	9	15	NW	7	12	SW
5/29/91 11:00	10	17	WSW	0	6	ENE	4	8	ENE	12	17	SSW	11	17	NW	8	15	SW
5/29/91 12:00	11	18	WSW	1	6	E	3	14	SSE	15	19	SSW	13	18	NW	11	15	SSW
5/29/91 13:00	12	19	WSW	11	24	SSW	8	15	SW	16	22	SSW	15	21	NW	12	17	SW
5/29/91 14:00	14	20	WSW	18	24	SSW	12	18	SW	19	23	SSW	17	22	WNW	15	19	SSW
5/29/91 15:00	14	22	WSW	18	25	SW	13	17	WSW	18	23	SSW	4	17	WSW	15	18	SSW
5/29/91 16:00	16	21	WSW	23	32	SW	14	18	WSW	18	23	SSW	5	19	S	17	20	SSW
5/29/91 17:00	14	21	WSW	16	24	SW	13	18	WSW	16	22	SSW	8	19	SSE	14	20	SSW
5/29/91 18:00	16	24	WSW	15	25	SSW	12	16	W	12	17	SSW	12	23	WNW	14	21	SW
5/29/91 19:00	13	19	WSW	7	18	SSW	11	15	WNW	9	12	SW	10	17	WNW	11	17	SW
5/29/91 20:00	16	22	WSW	20	32	W	10	14	NW	9	13	SW	5	12	WSW	12	16	SW
5/29/91 21:00	17	22	SW	17	26	WSW	10	18	NW	11	15	WSW	14	21	WNW	11	16	SSW
5/29/91 22:00	14	20	SW	16	24	WSW	9	12	NNW	9	16	SW	18	22	WNW	12	15	SW
5/29/91 23:00	17	26	WSW	6	22	SW	5	10	NW	9	16	WSW	16	23	WNW	8	12	SSW
5/30/91 0:00	18	24	SW	10	20	WSW	1	3	ESE	8	11	SW	14	21	WNW	13	19	WSW
5/30/91 1:00	17	24	SW	15	22	SW	9	19	NW	7	12	WSW	12	16	WNW	18	26	W
5/30/91 2:00	16	23	WSW	14	22	SW	11	16	NW	6	11	WSW	12	18	WNW	12	21	WSW
5/30/91 3:00	15	19	WSW	13	20	WSW	11	18	WNW	8	12	WSW	2	12	W	13	18	W
5/30/91 4:00	13	20	WSW	24	35	WSW	10	13	NW	9	15	WSW	6	15	WNW	14	18	WSW
5/30/91 5:00	17	22	WSW	30	39	WSW	5	10	NNW	14	18	W	4	10	WSW	12	18	WSW
5/30/91 6:00	14	18	WSW	33	42	WSW	5	14	N	10	16	SW	4	14	NW	16	21	WSW
5/30/91 7:00	16	22	WSW	27	34	WSW	5	11	N	13	17	SW	16	27	WNW	15	20	WSW
5/30/91 8:00	18	26	WSW	27	36	W	11	15	N	16	22	SSW	24	33	WNW	10	23	WSW
5/30/91 9:00	22	29	WSW	24	31	WSW	11	16	N	18	21	SSW	23	30	WNW	24	31	W
5/30/91 10:00	23	31	WSW	23	31	WSW	7	13	NNW	18	23	SSW	24	31	WNW	17	24	WSW
5/30/91 11:00	23	30	WSW	24	33	WSW	7	16	NNW	20	26	SSW	14	22	NW	19	25	SW
5/30/91 12:00	25	35	WSW	31	37	SW	6	11	NE	22	28	SSW	6	25	S	23	28	SSW
5/30/91 13:00	29	40	WSW	30	41	SW	5	19	NNE	24	30	SSW	15	23	SSE	23	30	SSW
5/30/91 14:00	26	36	W	30	40	SW	7	17	W	22	27	SSW	12	27	SSE	24	31	SSW
5/30/91 15:00	---	---	---	38	46	WSW	17	22	WNW	21	27	SSW	14	30	WNW	22	28	SSW
5/30/91 16:00	22	30	WSW	34	46	W	15	21	W	19	25	SSW	19	26	WNW	19	26	SW
5/30/91 17:00	22	28	WSW	18	33	W	14	20	NW	18	26	SSW	15	28	WNW	19	26	SW
5/30/91 18:00	20	27	WSW	13	19	NNE	18	28	NW	18	23	SSW	17	28	WNW	19	24	SW
5/30/91 19:00	16	23	WSW	12	19	NE	22	32	NW	12	18	SSW	20	29	WNW	16	26	W
5/30/91 20:00	13	19	WSW	9	20	NNE	17	27	NW	12	19	W	21	31	WNW	21	27	WNW
5/30/91 21:00	10	14	W	10	18	NNE	21	26	NNW	13	17	WNW	18	23	WNW	18	25	WNW
5/30/91 22:00	7	13	W	10	18	NNE	18	25	NW	16	20	WNW	16	24	W	19	24	WNW
5/30/91 23:00	8	12	WSW	10	18	NNE	15	21	WNW	16	22	WNW	19	22	W	17	23	W

Maximum PM_{10} Values by Site and Year

			# of Observations			24-Hour PM10 Values			
Site ID	**City**	**Year**	**AQMD**	**EPA**	**Req**	**1st**	**2nd**	**3rd**	**4th**
06071-0001	Barstow	1989	16	58	63	191	83	74	69
		1990	44	44/43	63	381	76	752	64
		1991	58	58	63	197	85	71	55
		1992	59	60/59	64	68	57	56	54
		1993	60	41	47	49	45	45	44
	inc	1994	46			44	42	41	39
06071-0006	Trona	1989	58	55/53	63	112	105	104	98
		1990	59	59	63	366	147	102	89
		1991	57	55	63	114	109	104	100
		1992	59	59/58	64	105	89	82	69
		1993	61	30	47	56	51	48	45
	inc	1994	45			76	55	52	51
06071-0013	Lucerne V	1989	38			45	45	44	43
		1990	59	35	48	317	313	195	187
		1991	49	49	63	389	117	96	76
		1992	47	47	64	42	41	40	37
		1993	61	41	47	54	41	39	37
	inc	1994	39			65	59	35	31
06071-7002	VV-FG	1990	30	18/15	32	181	105	79	73
	VV-FG/AR	1991	47	33	48	439	90	88	85
06071-0014	VV-AR	1992	60	60	64	62	55	55	52
		1993	58	40/39	47	62	61	60	57
	inc	1994	45			108	96	78	76
06071-1101	29 Palms	1989	16	49	63	155	146	105	86
		1990	52	51	63	297	286	145	79
		1991	47	47	63	297	139	98	81
		1992	60	60	64	46	44	42	41
06071-0017	move	1993	51	34/33	47	39	38	35	35
	inc	1994	41			67	44	36	33
06071-4001	Hesperia	1989	15	59	63	124	81	81	76
		1990	57	53	63	171	99	80	79
		1991	55	17	63	320	145	122	109
		1992	61	60	64	80	73	66	62
		1993	59	39	47	64	59	58	58
	inc	1994	46			76	54	53	51

Trona moved from Market to Athol in February 1993

Trona 1993 AQMD data includes Trona Market and Athol

1993 EPA data includes only Market after CARB took over

Victorville-Fairgrounds began 6/13/90

Victorville-Amargosa began April 1991

29 Palms moved in August 1993 (move of 1000 ft south)

Alan De Salvio MDAQMD

STATE OF CALIFORNIA PETE WILSON, Governor

AIR RESOURCES BOARD
2020 L STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

July 26, 1995

RECEIVED
EPA/CMD
95 JUL 28 PM 2:07

Mr. John Kennedy, Acting Chief
Air Planning Branch
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Dear ~~Mr. Kennedy~~ John:

Re: PM10 Exceptional Events for Mojave Desert AQMD Sites

As requested by the Mojave Desert Air Quality Management District (MDAQMD) staff, identified as affected by exceptional events are the following PM10 concentrations (included as Attachment A).

Date	Site Name	PM10 Concentration (ug/m3)
12/19/90	Barstow	381
	Lucerne Valley	187
	Twentynine Palms	297
02/17/91	Hesperia	320
	Lucerne Valley	389
	Twentynine Palms	297
	Victorville	439
05/30/91	Barstow	197

The basis for exceptional event flagging for the PM10 concentrations on December 19, 1990, and May 30, 1991, is the persistence of high winds at one or more PM10 sites at speeds that are not expected to recur routinely. The basis for exceptional event flagging for the PM10 concentrations on February 17, 1991, is a combination of high winds in the Mojave Desert and fugitive dust sources related to the prolonged California drought.

The encosed tables (1, 2, and 3) show the wind speed and wind direction data for six monitoring sites for December 19, 1990, February 17, 1991, and May 30, 1991, respectively. Each Table shows the data for the day in question and for the previous day.

Basis for December 19, 1990 and May 30, 1991:

On December 19, 1990, the hourly average wind speed reached 29 miles per hour (mph) at Twentynine Palms and 25 mph at Barstow, while gusts reached 40 mph and 33 mph, respectively. These included wind speeds which reached levels that qualify as exceptional events (hourly $\geq$ 30 mph or gusts, $\geq$ 40 mph) as described in the U.S. Environmental Protection Agency's (USEPA) exceptional event guideline.* High winds were persistent throughout the day. Hourly wind speeds of at least 20 mph occurred for 13 consecutive hours at Twentynine Palms, and 8 consecutive hours at Barstow.

Wind data are not available for Lucerne Valley. However, we believe the PM10 concentration at Lucerne Valley was also affected by high wind because the site is located approximately halfway between Twentynine Palms and Barstow.

On May 30, 1991, the wind was similarly high and persistent. On this day, the hourly wind speeds and gusts at Barstow reached 29 mph and 40 mph, respectively. These wind speeds also reached levels that would qualify as exceptional events, according to the USEPA's exceptional event guideline. In addition, high winds were persistent as hourly average wind speeds of at least 20 mph occurred for nine hours at Barstow.

Basis for February 17, 1991:

Although the wind speeds observed for the area encompassing Hesperia, Lucerne Valley, Twentynine Palms, and Victorville on this date do not quite qualify as exceptional events according to the USEPA's criteria, we believe the meteorological and air quality data show that these exceedances were the result of an exceptional event in Lancaster. On February 17, 1991, the wind speeds were also high but were slightly lower than those on the two days discussed above. The highest hourly average wind speed was 23 mph at Hesperia, and the highest gust was 29 mph at Victorville.

The Lancaster monitoring site recorded a PM10 concentration of 780 ug/m3 on this day. The PM10 data summary report for February 1991 for this site is shown in Attachment B. This is the highest PM10 measurement since 1990 when PM10 data collection began at Lancaster. The next two highest PM10 concentrations at this site were 342 ug/m3 and 215 ug/m3, recorded in November 1990 and May 1991, respectively.

Tables 4 and 5 show the wind speed data for Lancaster for February 16 and 17, 1991, respectively. Wind speeds started to increase in the evening on February 16, and reached an hourly average of 37 knots (43 mph), gusting to 43 knots (49 mph) in the afternoon on February 17. These wind speeds exceed the levels that would qualify as a high wind exceptional event in the USEPA's guideline. The winds were blowing mainly from west to east.

* Guideline on the Identification and Use of Air Quality Data Affected by Exceptional Events, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, N.C., # EPA-450/4-86-007 (July 1986).

Wind direction data for the Lancaster site are shown under William J. Fox Field (abbreviated as WJF) in Tables 6 and 7 for February 16 and 17, 1991, respectively. The four sites in the Mojave Desert AQMD with high PM10 concentrations on this day are located to the east of Lancaster (see map in Figure 1). Therefore, the high PM10 loadings from Lancaster would be carried downwind to impact the four sites in the MDAQMD.

As further evidence of the Lancaster area's impact on these sites, there was a pattern of a PM10 concentration gradient across the Mojave Desert sites. The PM10 concentrations for the sites from Lancaster to Twentynine Palms are listed below in the order of their locations from west to east.

Site Name	PM10 Conc. (ug/m3)
Lancaster	780
Victorville	439
Hesperia	320
Lucerne Valley	389
Twentynine Palms	297

According to the staff of the South Coast Air Quality Management District (see Attachment C), the high PM10 loadings at Lancaster may be attributable to the six-year drought in California. The drought caused the abandonment of many farmlands in the foothills area outside Lancaster and left the soil surfaces unprotected from the winds. The South Coast AQMD staff believes that this combination of a very severe drought with the associated fallow fields, and the persistence of high winds for at least two days, would be a condition not likely to recur more often than once every five years.

Table 8 gives the results of a chemical mass balance (CMB) modeling analysis for the PM10 concentrations for all three days in question. The bottom part of the table shows that crustal material accounted for as much as 82 percent of the PM10 mass on December 19, 1990, 91 percent on February 17, 1991, and 95 percent on May 30, 1991. These levels of crustal material indicate a high level of impact by wind-blown fugitive dust on the PM10 concentrations.

Conclusion

In conclusion, we believe there is ample evidence that the PM10 concentrations on December 19, 1990, February 17, 1991, and May 30, 1991, at the sites within the Mojave Desert AQMD as listed on page 1 of this letter, were affected by exceptional events. Further, there is evidence that the PM10 concentration at Lancaster on February 17, 1991, was also affected by an exceptional event. We recommend your approval to flag these data accordingly for purposes of determining compliance with the National PM10 Ambient Air Quality Standards.

If you have any questions regarding this matter, please contact Rich Bradley, Chief, Air Quality Data Branch, at (916) 322-6076, or David Ipps of his staff at (916) 323-2722.

Sincerely,

Terry McGuire, Chief
Technical Support Division

Enclosures

cc: Charles Fryxell, MDAQMD
Alan DeSalvio, MDAQMD
Karlyn Black, EO
Paul Buttner, EO
Rich Bradley, TSD
David Ipps, TSD

Fort Irwin Monitoring Commitment Letter

DEPARTMENT OF THE ARMY
HEADQUARTERS, NATIONAL TRAINING CENTER AND FORT IRWIN
FORT IRWIN, CALIFORNIA 92310-5000

REPLY TO
ATTENTION OF

JUL 14 1995

Directorate of Public Works

Mojave Desert Air Quality Management District
15428 Civic Drive, Suite 200
Victorville, California 92392-2383

Dear Mr. Heaston:

Our reply to your letter of June 28, 1995 requesting a commitment to monitor for ambient PM10 for the next twelve months is a firm guarantee from the National Training Center to accomplish this monitoring.

Since October 1994, we have operated six different monitoring sites on this installation. These sites were included in our PM10 protocol submitted and approved by your personnel. We will continue to sample at these sites and furnish your office with all data collected for the next twelve months.

If I can be of further assistance or you need any additional information, please contact Mr. Walt Perry at (619) 380-3737.

Sincerely,

Benjamin H. Butler

Benjamin H. Butler, P.E.
Lieutenant Colonel, U.S. Army
Director of Public Works

USMCAGCC Monitoring Commitment Letter

UNITED STATES MARINE CORPS
MARINE CORPS AIR GROUND COMBAT CENTER
TWENTYNINE PALMS, CALIFORNIA 92278-5000

IN REPLY REFER TO:
5090
3/ 345
21 Jul 95

Mojave Desert Air Quality Management District
Mr. Eldon Heaston, Deputy APCD
15428 Civic Dr., Suite 200
Victorville, CA 92392-2383

RE: MCAGCC PM_{10} AIR MONITORING COMMITMENT

MR. Heaston,

The Marine Corps supports the efforts of the Mojave Desert AQMD to redraw the boundary of the federal PM_{10} nonattainment area in the Morongo Valley. Our concern for the air quality of this region and the health of the residents and users of the area is evidenced by our continuing efforts to fund a year long study of the PM_{10} concentrations along the boundary of the Combat Center. It is expected that this study will begin in 1996 if federal funding is made available. If funding is not available in 1996, efforts to obtain funding will be pursued in 1997 and beyond until the study is completed. Results of the study will be available to your District and other interested parties.

Sincerely,

K. W. QUIGLEY
LtCol, U. S. Marine Corps
Natural Resources & Environmental
Affairs Directorate

Copy To:
Central Files

APPENDIX B: FILTER CHEMICAL ANALYSIS

TRC Sampling Analysis Excerpt

TRC Analysis Cover Letter and Results

EXECUTIVE SUMMARY

This study was conducted for the Mojave Desert Air Quality Management District (MDAQMD) to determine source category contributions to ambient PM_{10} levels on days with high measured concentrations. The EPA version 7.0 Chemical Mass Balance (CMB) receptor model was used to determine source category apportionments from measured ambient chemistry for particulate samples collected on quartz fiber filters using high-volume samplers at five different monitoring sites in the Mojave Desert region. These sites are known as the Twenty-nine Palms, Victorville, Hesperia, Barstow, and Lucerne ambient monitoring sites.

A total of 15 filter samples were submitted to TRC by the Mojave Desert Air Quality Management District (MDAQMD), but two of the samples were determined to have been collected on glass fiber filters instead of quartz fiber and were therefore incompatible with the carbon analysis method. Therefore, only 13 of the filters submitted could undergo proper chemical analysis for use with the CMB model.

Site-specific source profiles were developed to represent the Crustal source category by collecting two samples of crustal material near each receptor site. These samples were collected by MDAQMD personnel. This resulted in a total of ten bulk samples which were resuspended onto teflon and quartz filters. These filters were subjected to the same battery of chemical analyses as the ambient samples.

Chemical source profiles were also used to represent impacts from secondary sulfate and nitrate.

Because a preliminary CMB analysis showed that contributions from high-carbon sources (e.g., combustion byproducts, biological materials, tire wear, etc.) were relatively small for these ambient samples, only two high-carbon source profiles were included in the source profile library: a residential wood smoke profile from the Denver Brown Cloud Study (Watson, 1988) and a tire wear profile from a South Coast Air Quality Management District-sponsored study (TRC, 1990). This was appropriate in this case because insufficient supporting data were available to confidently resolve relative impacts from the various high-carbon source categories such as diesel exhaust, gasoline vehicle exhaust, residential wood combustion, tire wear, biological materials, etc. Therefore, the residential wood combustion profile included in the source profile library was used to apportion the total impact from all of these source categories combined. Because total impacts from this source category never exceeded 5% of the total PM_{10} mass in the final CMB results, the inability to resolve the contributions from the individual constituents of the high-carbon source category was not a serious shortcoming in the CMB analysis.

The observation of relatively high calcium and carbonate concentrations in several of the Lucerne samples, along with the existence of limestone mines and cement-producing facilities, suggested that source profiles representative of these sources should be included in the source profile library. Therefore, chemical profiles for limestone ($CaCO_3$) and lime (CaO) were included along with a source profile measured for a cement plant Klinker Tower stack at a cement-producing facility in Helena, Montana (CPP, 1991). Generally, these three profiles were used to represent ambient impacts from high-calcium sources such as fugitive emissions from lime and limestone mines and storage piles, stack emissions from cement plants, or other high-calcium sources in this airshed.

An automobile brake wear profile was also included in the profile library to assess impacts from this source category. This profile could be used to compensate for unexplained iron in the CMB fits.

With this source profile library, the CMB model was able to apportion particulate impacts from the following source categories: Crustal, High-Carbon, Sulfate, Nitrate, High-Calcium, and Brake Wear. It was found that these six source categories were able to adequately explain the observed ambient chemistry for 12 of the 13 samples modeled in this study.

The source apportionment results calculated by the CMB model are summarized in Table E-1.

At sites other than Lucerne, by far the most predominant source category contributing to the measured particulate concentrations was crustal materials. This category typically accounted for 80 to 90 percent of the measured concentration values at Twenty-nine Palms, Victorville, Hesperia, and Barstow. Small contributions (less than about 5 percent) from the High-Carbon, Sulfate, and Nitrate source categories were also noted.

In four of the samples collected at the Lucerne site, source apportionments from the High-Calcium source category were calculated. These contributions ranged from about 4 to 36 percent of the measured ambient particulate concentration. At the Lucerne site, there was a correlation between higher contributions from the High-Calcium source category and lower percent mass explained. This suggests that additional mass from this source category is being carried along with the High-Calcium chemistry that is not being accounted for. Because this category is likely to consist of large fractions of limestone and lime, the unapportioned mass could be explained by waters of hydration not accounted for in the CMB analysis. For example, limestone often exists as $CaCO_3 \cdot 6H_2O$ which would more than double the contribution from limestone calculated as $CaCO_3$. If the contributions from the High-Calcium source category were doubled in the apportionment results, the unexplained mass values would be in the same range as those calculated for the other sites.

The only sample which had ambient chemistry which could not be explained by the profiles in the source profile library was the one collected on 10/13/89 at the Barstow site. This sample had measured ambient zinc and barium concentrations significantly higher than the other samples ($[Zn]=2.00\ \mu g/m^3$ and $[Ba]=3.20\ \mu g/m^3$). TRC has been unable to identify a source in this airshed which would be expected to have emissions composed primarily of zinc and barium. In order to provide apportionment estimates for the identified source categories, Zn was removed as a fitting species for this sample. By doing so, only 43% of the measured mass was explained by the categories represented in the source profile library. Therefore, a significant source category is not being apportioned in this sample. This unknown source category was not identified in this study.

TRC Environmental Corporation

12242 Southwest Garden Place
Tigard, Oregon 97223
Telephone 503-624-2773
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May 16, 1995

Mr. Eldon Easton
Deputy Air Pollution Control Officer
Mojave Desert AQMD
15428 Civic Drive, Suite 200
Victorville, California 92392-2383

Dear Mr. Easton:

TRC Environmental has completed laboratory analysis and Chemical Mass Balance (CMB) receptor modeling of an ambient PM_{10} filter taken at Barstow, California on May 30, 1991. The procedures used in this analysis and modeling were exactly the same as those of the report titled "Apportionment of Ambient PM_{10} Within the Mojave Desert Using Chemical Mass Balance Receptor Modeling Techniques," submitted May 4, 1995.

A quartz fiber PM_{10} filter was submitted to TRC by the Mojave Desert Air Quality Management District (MDAQMD). This filter was analyzed for elemental content by x-ray fluorescence, for ion content by ion chromatography, and for elemental carbon, organic carbon, and carbonate carbon by the thermal/optical carbon method.

The ambient filter was similar to the thirteen filters analyzed previously (TRC 1995) in that the predominant species measured were aluminum (Al), potassium (K), calcium (Ca), iron (Fe), organic carbon (OC), nitrate (NO_3^-), and carbonate (CO_3^-). In addition, the percentages of total mass of these species were close to those found in the average filter from the first study. Unlike the 10/13/89 Barstow filter that was found in the first report to have high barium (Ba) and zinc (Zn), this filter contained virtually no Ba or Zn.

The same source profile library was used in this modeling as in the first study. These source profiles are summarized in Table 1.

The EPA version 7.0 CMB model was used to determine source apportionments from the source categories described in Table 1. The modeling was done in accordance with EPA guidelines, which are described in section 2 of the first report. The fitting species were the same as in the first study: Al, K (from XRF), Ca, Ti, Mn, Fe, Zn, Rb, Sr, Pb, OC, EC, SO_4^{2-}, NO_3^-, and CO_3^-. The apportionment results are summarized in Table 2, where the results from the previous study have been included for comparison.

TRC *Environmental Corporation*

All modeling evaluation parameters were within EPA guidelines: the R-Square value was close to 1 (0.97), Chi-Square was good at 1.14, the degrees of freedom were well above 5 (12), and the percent mass explained was 100%.

The dominant source contribution was from crustal material, which accounted for 96% of the PM_{10}. Secondary sulfate and secondary nitrate accounted for the remaining 4%. The crustal source profile used in the best model run was from 29 Palms. This crustal apportionment should be viewed in general terms, without being interpreted to mean that the crustal material came specifically from 29 Palms. Several other profiles, including one from Barstow, also produced acceptable fits. The 29 Palms chemical source profile happened to best fit the chemical profile of the ambient filter on that sample day. Graphs of the model results are presented in Figures 1, 2, and 3.

The meteorology was examined on the sample day. The wind direction averaged 250 ± 10.6 degrees. The wind speed averaged 17.8 ± 5.6 mph and the highest hourly average wind speed was 29 mph. These speeds are well above the estimated 13 mph needed for dust reentrainment, and serve to confirm the apportionment of crustal materials as the dominant source impact. It is unlikely that the small secondary sulfate and secondary nitrate source contribution estimates were caused by sources within the Barstow community, given the high wind speeds which would not allow sufficient time for the sulfate and nitrate to be formed from their precursors.

The modeling results have been provided as attachment 1. The laboratory results may be found in attachment 2. If you or your staff have any questions regarding this report, please call Dr. Patterson, Dr. Cooper, or me. Thank you for your business.

Sincerely,

Chris Tawney

Chris Tawney
Air Quality Engineer

Attachments

CWT/wdm\CF\18504\PO5RP015.W51

Table 1. CMB Source Profile Library—Description and Chemical Composition

Code #	Mnemonic	Profile Description	Al	K	Ca	Ti	Mn	Fe	Zn	Rb
1	BARST_1	Barstow Soil - Helipad	7.552	1.994	7.086	0.378	0.079	3.990	0.033	0.011
2	BARST_2	Barstow Soil - Mojave River Bed Area	9.301	2.229	3.989	0.569	0.126	6.193	0.039	0.017
3	VICTOR_1	Victorville Soil - Fairgrounds	8.133	2.482	5.763	0.467	0.093	5.128	0.055	0.013
4	VICTOR_2	Victorville Soil - Construction Site, Road	6.397	1.483	10.520	0.361	0.084	4.537	0.013	0.012
5	HESPER_1	Hesperia Soil - Road	11.430	2.583	1.411	0.580	0.135	5.388	0.016	0.015
6	HESPER_2	Hesperia Soil - Home Construction Site	11.880	2.867	1.257	0.645	0.173	5.429	0.017	0.018
7	LUCERN_1	Lucerne Valley Soil - Road	8.494	2.080	5.751	0.579	0.140	4.988	0.016	0.013
8	LUCERN_2	Lucerne Valley Soil - Construction Site	10.110	2.274	2.520	0.596	0.166	5.461	0.014	0.016
9	29PALM_1	29 Palms Soil - Road	9.767	2.912	4.725	0.287	0.060	3.032	0.019	0.012
10	29PALM_2	29 Palms Soil - Road	9.326	2.291	3.427	0.357	0.083	3.905	0.021	0.013
11	KLINKR91	Klinker Tower Stack	0.142	1.393	18.267	0.081	0.054	1.187	0.105	0.001
12	RWC-DNVR	Residential Wood Combustion - Denver	0.000	0.303	0.050	0.000	0.002	0.001	0.032	0.000
13	SECSO4	Secondary Sulfate[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	BKWEAR	Brake Wear	0.232	0.217	1.730	0.457	0.065	24.798	0.496	0.007
15	TRWEAR	Tire Wear	0.000	0.011	0.025	0.032	0.000	0.060	0.642	0.000
16	SECNO3	Secondary Nitrate[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	CACO3	Limestone	0.000	0.000	40.000	0.000	0.000	0.000	0.000	0.000
18	CAO	Lime	0.000	0.000	71.400	0.000	0.000	0.000	0.000	0.000

Code #	Mnemonic	Profile Description	Sr	Pb	OC	EC	SO_4	NO_3	CO_3	Reference
1	BARST_1	Barstow Soil - Helipad	0.040	0.035	2.740	0.000	0.057	0.051	1.950	b
2	BARST_2	Barstow Soil - Mojave River Bed Area	0.042	0.013	2.700	0.000	0.526	0.149	1.050	b
3	VICTOR_1	Victorville Soil - Fairgrounds	0.045	0.038	5.380	0.000	0.160	0.479	1.130	b
4	VICTOR_2	Victorville Soil - Construction Site, Road	0.054	0.005	0.520	0.000	0.060	0.040	2.940	b
5	HESPER_1	Hesperia Soil - Road	0.029	0.004	1.050	0.000	0.057	0.055	0.000	b
6	HESPER_2	Hesperia Soil - Home Construction Site	0.027	0.002	1.160	0.000	0.029	0.149	0.000	b
7	LUCERN_1	Lucerne Valley Soil - Road	0.025	0.002	1.070	0.000	0.041	0.084	1.500	b
8	LUCERN_2	Lucerne Valley Soil - Construction Site	0.019	0.005	0.670	0.000	0.096	0.072	0.290	b
9	29PALM_1	29 Palms Soil - Road	0.049	0.008	1.530	0.000	0.046	0.043	1.140	b
10	29PALM_2	29 Palms Soil - Road	0.037	0.012	4.250	0.000	0.039	0.061	0.680	b
11	KLINKR91	Klinker Tower Stack	0.071	0.000	0.400	0.073	0.457	0.183	0.000	CPP, 1991
12	RWC-DNVR	Residential Wood Combustion - Denver	0.000	0.000	64.000	19.000	0.000	0.000	0.000	Watson, 1988
13	SECSO4	Secondary Sulfate[a]	0.000	0.000	0.000	0.000	83.480	0.000	0.000	--
14	BKWEAR	Brake Wear	0.096	0.013	4.000	2.000	0.000	0.000	0.000	TRC, 1990
15	TRWEAR	Tire Wear	0.001	0.001	55.000	40.000	0.000	0.000	0.000	TRC, 1990
16	SECNO3	Secondary Nitrate[a]	0.000	0.000	0.000	0.000	0.000	77.500	0.000	—
17	CACO3	Limestone	0.000	0.000	0.000	0.000	0.000	0.000	60.000	—
18	CAO	Lime	0.000	0.000	0.000	0.000	0.000	0.000	0.000	—

a. Assumed to be ammonium salt. b. Developed for this study.

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Table 2. Summary of CMB Source Category Apportionments

Site	Date	Fraction	R-Square	% Mass	Chi-Square	Degrees of Freedom	Measured Mass ($\mu g/m^3$)	Calculated Mass ($\mu g/m^3$)	Source Category Apportionments ($\mu g/m^3$)					Unexplained
									Crustal	High Carbon	High Calcium	Sulfate	Nitrate	
29 Palms	02/17/91	PM_{10}	0.98	85.6	0.83	11	297.5	254.79	249.88	0.00	0.00	1.05	3.86	42.71
29 Palms	12/19/90	PM_{10}	0.96	85.4	1.34	11	297.1	253.75	244.39	0.00	0.00	1.72	7.64	43.35
Barstow	05/30/91	PM_{10}	0.97	100.0	1.14	12	196.8	196.8	188.68	0.00	0.00	3.51	4.60	0.00
Barstow	12/19/90	PM_{10}	0.98	82.9	0.88	11	380.9	315.62	307.64	0.00	0.00	1.27	6.71	65.28
Barstow	10/13/89	PM_{10}	0.85	42.8	4.92	10	190.6	81.64	66.66	9.75	0.00	3.55	1.69	108.96
Hesperia	02/17/91	PM_{10}	0.96	94.0	1.57	12	320	300.89	292.62	0.00	0.00	3.30	4.98	19.11
Hesperia	11/02/90	PM_{10}	0.98	88.7	0.92	10	171.3	151.88	144.55	3.31	0.00	1.32	2.70	19.42
Lucerne	05/30/91	PM_{10}	0.95	72.5	1.65	10	74.37	53.93	41.56	3.17	2.72	2.92	3.56	20.44
Lucerne	02/17/91	PM_{10}	0.98	83.8	0.81	11	389.1	325.98	321.54	0.00	0.00	0.96	3.48	63.12
Lucerne	12/19/90	PM_{10}	0.98	67.1	0.63	9	187.2	125.70	80.34	5.52	31.25	1.79	6.80	61.50
Lucerne	11/01/90	PM_{10}	0.97	93.3	1.07	11	194.5	181.47	176.22	0.00	0.00	1.84	3.41	13.03
Lucerne	05/23/90	PM_{10}	0.95	50.9	1.81	8	312.8	159.19	40.64	2.47	110.86	1.67	3.54	153.61
Lucerne	02/16/90	PM_{10}	0.97	53.5	1.19	8	317.3	169.89	38.22	7.76	114.29	2.32	7.30	147.41
Victorville	02/17/91	PM_{10}	0.97	80.7	1.20	11	438.6	353.82	346.79	0.00	0.00	2.07	4.96	84.78
Average			0.96	77.23	1.43	10.36	269.15	208.95	181.41	2.28	18.51	2.09	4.64	60.19

Site	Date	Fraction	R-Square	% Mass	Chi-Square	Degrees of Freedom	Measured Mass ($\mu g/m^3$)	Calculated Mass ($\mu g/m^3$)	Source Category Apportionments (%)					Unexplained
									Crustal	High Carbon	High Calcium	Sulfate	Nitrate	
29 Palms	02/17/91	PM_{10}	0.98	85.6	0.83	11	297.5	254.79	83.99	0.00	0.00	0.35	1.30	14.36
29 Palms	12/19/90	PM_{10}	0.96	85.4	1.34	11	297.1	253.75	82.26	0.00	0.00	0.58	2.57	14.59
Barstow	05/30/91	PM_{10}	0.97	100.0	1.14	12	196.8	196.8	95.88	0.00	0.00	1.78	2.34	0.00
Barstow	12/19/90	PM_{10}	0.98	82.9	0.88	11	380.9	315.62	80.77	0.00	0.00	0.33	1.76	17.14
Barstow	10/13/89	PM_{10}	0.85	42.8	4.92	10	190.6	81.64	34.97	5.11	0.00	1.86	0.89	57.17
Hesperia	02/17/91	PM_{10}	0.96	94.0	1.57	12	320	300.89	91.44	0.00	0.00	1.03	1.55	5.97
Hesperia	11/02/90	PM_{10}	0.98	88.7	0.92	10	171.3	151.88	84.38	1.93	0.00	0.77	1.58	11.34
Lucerne	05/30/91	PM_{10}	0.95	72.5	1.65	10	74.37	53.93	55.89	4.26	3.66	3.93	4.79	27.48
Lucerne	02/17/91	PM_{10}	0.98	83.8	0.81	11	389.1	325.98	82.64	0.00	0.00	0.25	0.89	16.22
Lucerne	12/19/90	PM_{10}	0.98	67.1	0.63	9	187.2	125.70	42.92	2.95	16.69	0.96	3.63	32.85
Lucerne	11/01/90	PM_{10}	0.97	93.3	1.07	11	194.5	181.47	90.60	0.00	0.00	0.94	1.75	6.70
Lucerne	05/23/90	PM_{10}	0.95	50.9	1.81	8	312.8	159.19	12.99	0.79	35.44	0.53	1.13	49.11
Lucerne	02/16/90	PM_{10}	0.97	53.5	1.19	8	317.3	169.89	12.05	2.44	36.02	0.73	2.30	46.46
Victorville	02/17/91	PM_{10}	0.97	80.7	1.20	11	438.6	353.82	79.07	0.00	0.00	0.47	1.13	19.33
Average			0.96	77.23	1.43	10.36	269.15	208.95	66.42	1.25	6.56	1.04	1.97	22.77

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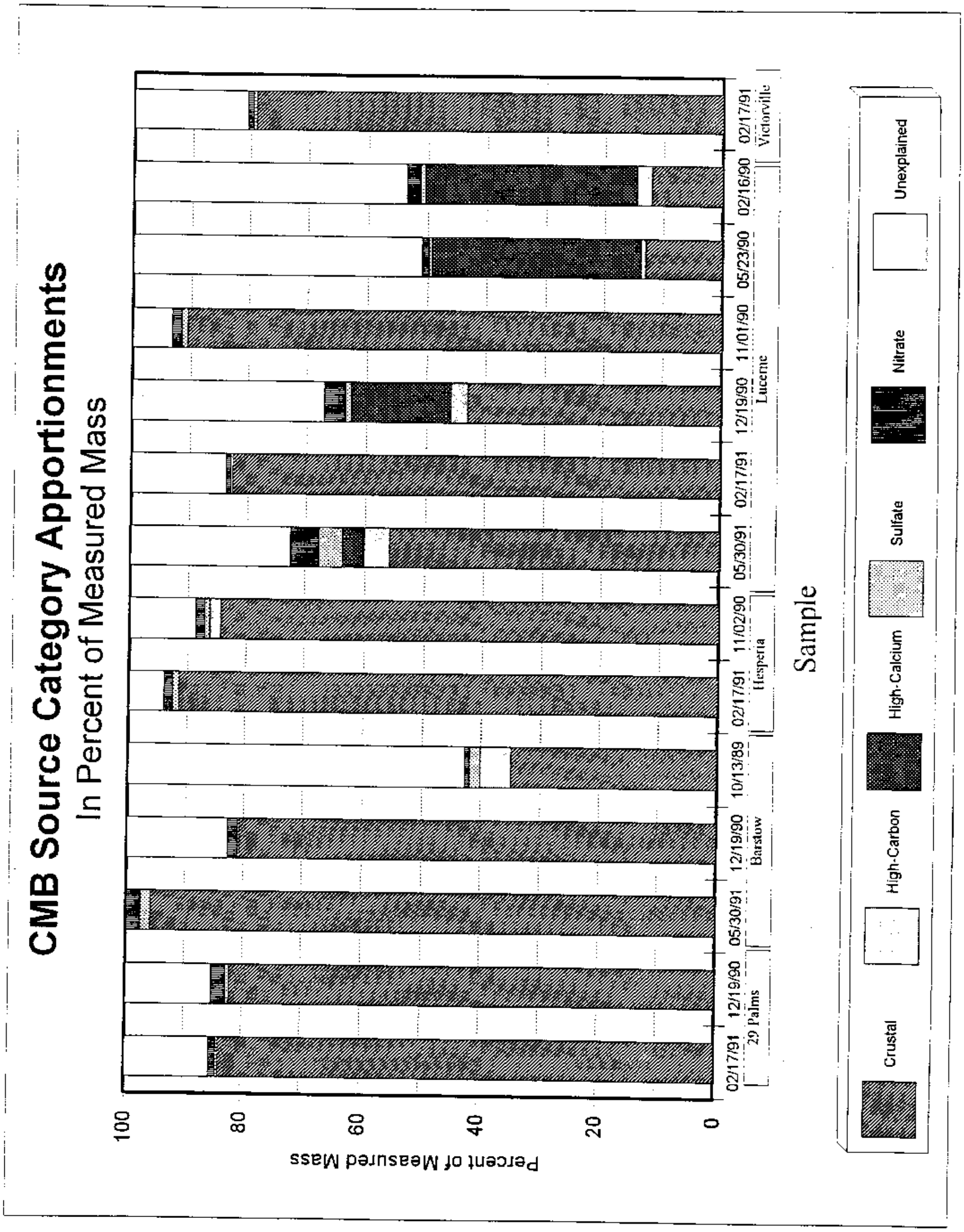
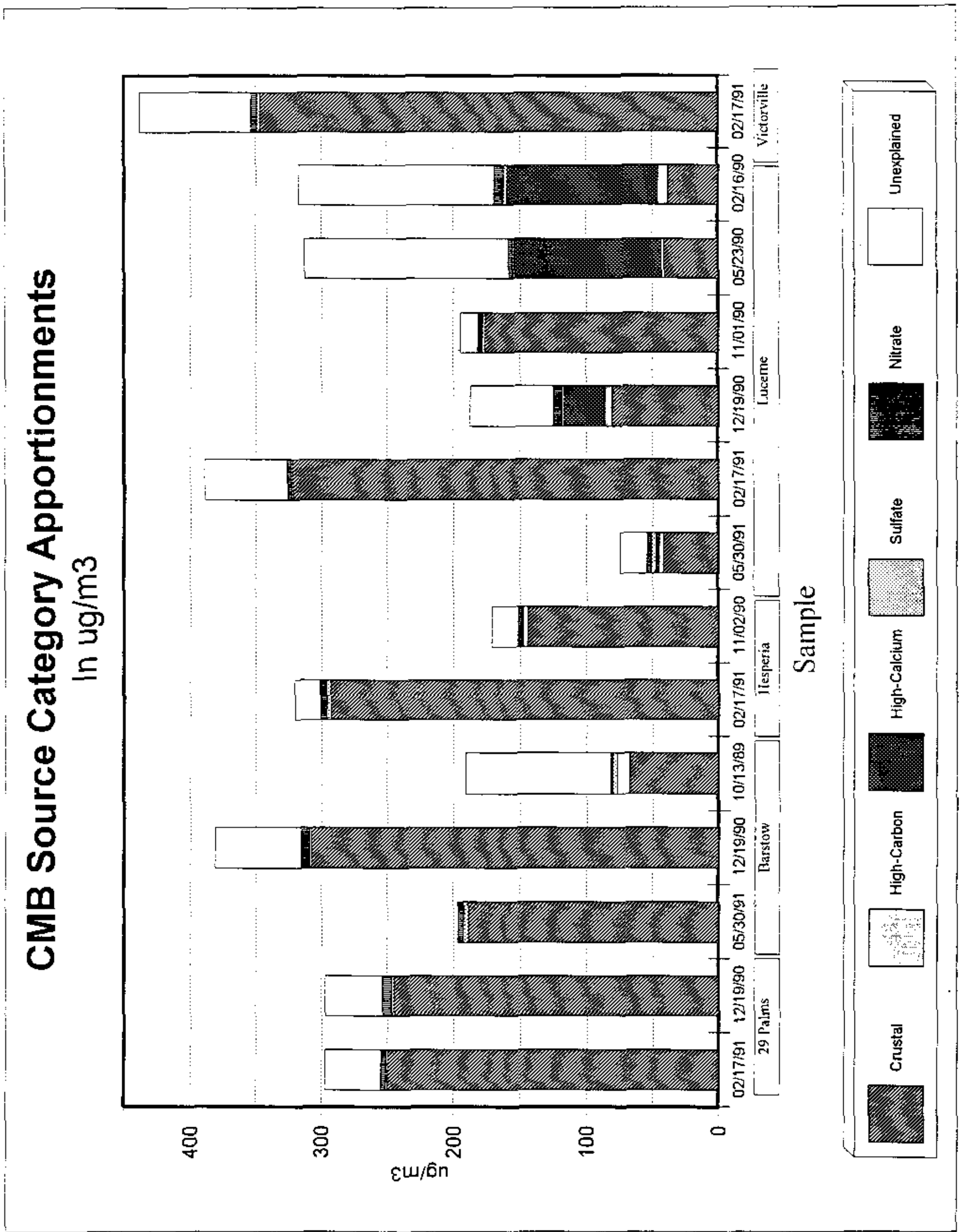
Figure 2



CMB Source Category Apportionments
In Percent of Measured Mass
Percent of Measured Mass
100
80
60
40
20
0
02/17/91
12/19/90
29 Palms
05/30/91
12/19/90
Barstow
10/13/89
02/17/91
Hesperia
11/02/90
05/30/91
02/17/91
12/19/90
Lucerne
11/01/90
05/23/90
02/16/90
02/17/91
Victorville
Sample
Crustal
High-Carbon
High-Calcium
Sulfate
Nitrate
Unexplained

Figure 3


CMB Source Category Apportionments
In ug/m3
ug/m3
0
100
200
300
400
02/17/91
12/19/90
05/30/91
12/19/90
10/13/89
02/17/91
11/02/90
05/30/91
02/17/91
12/19/90
11/01/90
05/23/90
02/16/90
02/17/91
29 Palms
Barstow
Hesperia
Lucerne
Victorville
Sample
Crustal
High-Carbon
High-Calcium
Sulfate
Nitrate
Unexplained

APPENDIX C: Annual PM_{10} Emission Inventories

I. Introduction

This appendix presents 1989, 1990, 1991, and 1992 PM_{10} emission inventories for the Mojave Desert Planning Area. These inventories serve as the basis for each exceedance day and exceedance year inventory used in the Plan. The exceedance day and exceedance year inventories were used to make planning assumptions and craft attainment strategies. In addition, these inventories provide the baseline for projected inventories through the attainment year, 2000. The inventories tabulate PM_{10} emissions in tons per year (tpy) and tons per day (tpd). This appendix concludes with a summary of the data for each year, as well as the projected year inventories.

II. Presentation Format

Sources are presented in three groups: stationary sources, area sources, and on-road sources. Within each group, sources are organized by category based on industry or activity type. PM_{10} emissions are totaled for each facility and category in tons per year, and for each category in tons per day in 1990. Standard Industrial Classification (SIC) codes, Source Classification Codes (SCC), and Emission Inventory Code (EIC) numbers are given for each category where known. These codes and numbers attempt to identify industry, activity and process, and may not accurately represent each facility. The emission data is presented individually in tabular format with category totals. Italicized values have been estimated or interpolated by the District to account for missing data. '---' indicates a facility or process that did not operate.

III. Stationary Sources

For the purposes of this document, Stationary Sources are typically large-scale, fixed facilities or operations with significant District-permitted equipment. Each District facility submits an annual criteria inventory that details emissions, activity rates and emission factors. These criteria emission inventory submissions were the primary data and methodology source used for stationary sources. Source test data was used where available to estimate emissions; otherwise the best available emission factors were used.

<u>Cement Manufacturing</u>
1990: 2.58 tpd

SIC 3241 (Hydraulic Cement Manufacturing)
Primary SCC 3-05-006-06 (Cement Manufacturing Dry Process Kilns)

	1989	1990	1991	1992
Mitsubishi Cement/Lucerne Valley (90:2465k, 91:2877k, 92:2552k)				
Clinker Storage and Transfer			0.09	0.10
South Cement Truck Loadout			0.01	0.02
Railroad Car Unload and Storage			0.15	0.16
Crushers			0.49	0.51
Clay Processing			0.04	0.04
Pre-Blending Stockpile			0.75	0.78
Raw ADTV Storage			0.01	0.01
Raw Grinding			0.23	0.24
Kiln			3.33	3.45
Clinker Storage			0.01	0.01
Finish Mill #4			0.01	0.01
Finish Mill #1			0.01	0.01
Kiln Feed Blending			0.19	0.19
Cement Loadout			0.02	0.02
Coal Grinding Mill #3			0.01	0.01
Coal Grinding Mill #4			0.02	0.02
Cement Unloading EQ to Silo			0.01	0.01
Clinker Cooler			0.12	0.13
Clinker Reclaim			0.09	0.09
Clinker Storage			0.01	---
Two IC Engine Compressors			*0.42*	0.42
Three Drill IC Engines			*0.62*	0.62
Raw Mill Storage			0.04	0.04
Admix, Finish or Wet Raw Silos			0.01	---
Gypsum Silo			---	0.01
Cement Unload Equipment			0.01	---

Gasoline Vehicles			0.14	0.14
Diesel Vehicles			0.38	0.40
Heavy Duty Diesel Vehicles			5.84	1.20
Blasting		*98.59*	*115.07*	*102.08*
Quarry Truck Loading			11.38	11.82
Storage Pile Wind Erosion			0.31	0.31
Batch Drop Piles			0.02	0.02
Overburden Piles			88.61	92.04
Overburden Truck Transfer			71.63	*71.63*
Unpaved Haul Roads			117.74	122.30
Natural Gas Space Heating			0.04	0.03
Totals:	417.86	417.86	417.86	408.87
Riverside Cement/Oro Grande (89:2053k, 90:1951k, 91:1791k, 92:1415k)				
Primary Crushing		35.64	19.20	17.92
Raw Mills		1.41	0.68	0.57
Coal Handling		1.18	1.16	3.66
7 Coal Kilns/NG Preheat		111.06	106.57	93.20
Clinker Handling		5.41	4.55	4.83
Gypsum Handling		1.35	1.37	12.40
Kiln Dust Handling		0.32	0.12	1.62
Five Finish Mills		5.47	4.53	4.55
Cement Handling		1.02	1.03	0.39
Storage Piles		5.01	5.01	5.17
NG Boilers		0.36	0.32	---
Blasting		*78.03*	*71.65*	*56.60*
Unpaved Roads		37.12	34.08	26.92
Vehicles		0.17	*0.17*	*0.17*
Heavy Equipment		6.05	*6.05*	*6.05*
Locomotives		0.70	*0.70*	*0.70*
Miscellaneous Equipment		0.56	*0.56*	*0.56*
Totals:	290.86	290.86	257.75	235.31
Southwest Portland Cement/AV-VV (90:2888k)				
Two Raw Mills		2.99		
Two Coal Kilns/Coolers		74.70		
Bulk Clinker Shipping		0.07		
Limestone Reclaim		0.34		
Stone Reclaim		0.30		
Clinker Handling		0.53		
Plant Clinker Handling	0.54			
Six Finish Mills		13.86		
Cement Handling		12.33		
Rail Haulage		1.04		
Rail Reclaim		0.81		
Railroad Loading		0.13		
Stockpiles		0.34		

Blasting		*115.53*		
Unpaved Road Travel				
Diesel Mobile Equipment		10.70		
Gasoline Mobile Equipment		0.26		
Propane Mobile Equipment		0.03		
Totals:	234.50	234.50	234.50	234.50
Category Totals (tpy):	**943.22**	**943.22**	**910.11**	**878.68**

<u>Concrete Batch and Asphalt Plants</u>
1990: 0.28 tpd

SIC 1422 (Crushed and Broken Limestone)
SIC 2951 (Asphalt Paving Mixtures and Blocks)
SIC 3273 (Ready-Mixed Concrete)

	1989	1990	1991	1992
Agcon/Adelanto (80k tput)				
Batch Plant	0.09	0.09		
Materials Handling	*2.25*	*2.25*		
Stockpiles	*0.11*	*0.11*		
Diesel Generator	*0.08*	0.08		
Totals:	2.53	2.53	2.53	2.53
Agcon/Oro Grande (202k tput)				
Batch Plant	0.37	0.37		
Materials Handling	5.63	5.63		
Stockpiles	*0.50*	0.50		
Diesel Generator	*0.08*	0.08		
Totals:	6.58	6.58	6.58	6.58
Bartholomew Enterprises/#420				
Gasoline Mobile Equipment			0.20	0.10
Diesel Mobile Equipment			0.20	0.10
Totals:	---	---	0.40	0.20
Boral Resources/Victorville (145k, 180k, 185k 89/90/91 tputs)				
Asphalt Heater	0.01	0.02	0.01	
Natural Gas Asphalt Plant	3.63	4.20	0.92	
865 bhp Diesel IC Engine	0.25	0.14	0.62	
Front End Loaders	0.13	*0.24*	0.24	
Materials Handling	6.54	*8.12*	*8.34*	
Haul Roads	3.63	2.65	*2.65*	
Totals:	14.19	15.37	12.78	12.78
Boral Resources/Lucerne Valley (11k tput)				
Asphalt Plant	0.26	0.08		
Asphalt Heater	*0.01*	0.01		
Front End Loader	0.02	0.06		

Materials Handling	0.47	*0.47*			
Haul Road	0.79	0.11			
Totals:	1.55	0.73	0.73	---	
Cal-Ci-Co Rock/Hinkley (59k tput)					
Batch Plant	0.17				
Stockpiles	23.81				
Totals:	23.98	---	---	---	
E.L. Yeager/Barstow (89:74k, 90:25k, 91:101k)					
Asphalt Plant		3.10	0.50		
NG Asphalt Heater		0.04	*0.04*		
Diesel Front End Loader		*0.07*	*0.07*	0.07	
Totals:	3.21	3.21	0.61	0.61	
Everett L. Hodges					
Concrete Plant	0.01	*0.01*	0.01	*0.01*	
FNF Construction/#1223					
Aggregate Circuit			2.46		
Diesel IC Engine			0.33		
LPG Asphalt Plant			0.08		
LPG IC Engine			0.17		
Totals:	---	---	3.05	3.05	
Granite Construction/29 Palms-#315 (89:233k, 90:233k, 91:78k)					
Concrete Batch Plant	0.82	0.82	0.39		
Cement Handling	7.02	7.02	3.29		
Crushing Plant	2.08	2.08	3.77		
Diesel Equipment	*0.21*	0.21	0.02		
Totals:	10.13	10.13	7.47	7.47	
Granite Construction/Yucca Valley-#595 (89:56k, 90:56k, 91:20k)					
Concrete Batch Plant	0.14	0.14	0.05	0.08	
Cement Handling	0.07	0.07	0.02	*0.02*	
Totals:	0.21	0.21	0.07	0.10	
Hi-Grade Materials/Hesperia (89:382k, 90:281k, 91:212k)					
Concrete Batching	11.79	*8.67*	*6.55*		
Misc. Fuel Combustion	*0.11*	*0.08*	0.06		
Vehicular Traffic	*5.32*	3.91	2.12		
Stockpiles	*5.90*	4.34	*3.27*		
Totals:	23.12	17.00	12.00	12.00	
Industrial Asphalt/Oro Grande (90:395k, 91:353k, 92:307k)					
Screens			5.65	5.05	9.88
Conveyor Belt Transfer		1.32	1.17	1.02	
Cone Crusher		0.97	0.86	0.75	
Jaw Crusher		3.08	2.75	0.71	
Truck Loadout		0.55	0.50	0.43	
Asphalt Batch Plant		0.43	0.38	0.85	
Bins		0.57	0.51	0.44	

Aggregate Storage Bins		0.12	0.11	0.10
Storage Piles		0.18	0.16	0.14
Haul Trucks		30.75	39.00	27.25
Totals:	43.62	43.62	50.49	41.57
Owl Rock Products/Victorville #74 (9:168k)				
Concrete Batch	0.21	0.21	0.21	0.30
Owl Rock Products/Barstow #252 (90:68k)				
Concrete Batch	0.09	0.09	0.09	0.06
Victor Valley Ready Mix/Hesperia (90:162k, 91:112k)				
Concrete Batch Plant		0.30	0.21	
Unpaved Roads		0.28	0.30	
Active Piles		0.35	0.21	
Diesel Equipment		0.12	0.06	
Totals:	1.05	1.05	0.78	0.78
Category Totals (tpy):	**130.5**	**100.7**	**97.8**	**88.8**

Electric Utility and Electricity Generation Facilities
1990: 0.48 tpd

SIC 4911 (Electric Services)
SCC 2-01-002-01 (Natural Gas Turbine Generator)
SCC 1-03-006-01 (Industrial Natural Gas Boiler 10-100 MMBtu/hr)

	1989	1990	1991	1992
Daggett Leasing/Daggett (SEGS I & II)				
Diesel Generator			0.01	---
Superheater			---	0.03
Cooling Towers			0.84	0.91
Two Natural Gas Boilers			0.30	0.14
Auxiliary Heaters			---	0.01
Mobile Diesel Equipment			0.09	0.14
Mobile Gasoline Equipment			0.02	0.04
Vehicle Fugitive Dust			*22.97*	*23.41*
Totals:	24.23	24.23	24.23	24.68
Harper Lake/Harper Lake (SEGS VIII & IX)				
Two Natural Gas Heaters				1.66
Two Diesel Generators				0.01
Diesel Fire Pumps				0.01
Cooling Towers				0.79
Vehicle Fugitive Dust				5.53
Mobile Diesel Equipment				0.03
Mobile Gasoline Equipment				0.01
Totals:	---	---	8.04	8.04
Kramer Junction/Kramer Junction (SEGS III - VII)				

Diesel IC Engines			0.07	0.06
Gasoline Mobile Equipment			0.10	0.09
Diesel Mobile Equipment			0.15	0.21
Diesel Equipment			0.07	0.06
Cooling Towers			4.51	3.99
Vehicle Fugitive Dust			29.81	29.36
Natural Gas Boilers			1.78	1.79
Totals:	36.49	36.49	36.49	35.56
Southern California Edison, Coolwater/Daggett				
Two NG Boilers	6.50	4.03	1.34	1.44
Two NG Turbines	155.10	111.17	46.16	72.84
Totals:	161.60	115.20	47.50	74.28
U.S. West/Oro Grande				
Two Natural Gas Boilers	---	---	---	0.44
Category Totals (tpy):	**222.32**	**175.92**	**116.26**	**143.00**

General Aviation

1990: 0.01 tpd

SIC 4581 (Airports, Flying Fields and Airport Terminal Services)

	1989	1990	1991	1992
Apple Valley Airport/Apple Valley				
General Aviation Aircraft		2.49		
Barstow-Daggett Airport/Daggett				
General Aviation Aircraft		2.49		
Hesperia Airport/Hesperia				
General Aviation Aircraft		0.01		
Twentynine Palms Airport/Twentynine Palms				
General Aviation Aircraft		0.01		
Category Totals (tpy):	**5.00**	**5.00**	**5.00**	**5.00**

Incinerators

1990: 0.00 tpd

SIC 4953 (Incinerator Operation)

	1989	1990	1991	1992
Mountain Valley Memorial Park/Joshua Tree				
Incinerator	0.00	0.00	0.00	0.01
Victor Valley Memorial Park/Victorville				
NG Crematorium	0.03	0.03	0.03	0.03
Category Totals (tpy):	**0.03**	**0.03**	**0.03**	**0.04**

Landfills
1990: 1.64 tpd

SIC 4953 (Sanitary Landfill Operation)

	1989	1990	1991	1992
Apple Valley/Apple Valley				
Unpaved Road Travel		58.74		
Working Face		3.06		
Delivery Vehicle Exhaust		0.02		
Diesel Equipment Exhaust		0.47		
Wind Erosion		8.00		
Totals:		70.29		
Barstow/Barstow				
Unpaved Road Travel		19.90		
Paved Road Travel		3.40		
Working Face		0.38		
Delivery Vehicles		0.03		
Diesel Equipment Exhaust		1.00		
Wind Erosion		8.00		
Totals:		32.71		
Big Bear/Baldwin Lake (100 atpdw)				
Unpaved Road Travel		2.73		
Paved Road Travel		1.85		
Working Face		0.26		
Diesel Equipment Exhaust		0.60		
Wind Erosion		2.00		
Totals:		7.44		
Hesperia/Hesperia				
Unpaved Road Travel		45.16		
Working Face		10.83		
Delivery Vehicle Exhaust		0.02		
Diesel Equipment Exhaust		1.03		
Wind Erosion		8.00		
Totals:		65.04		
Landers/Landers (173 atpdw)				
Delivery Vehicles		0.49		
Unpaved Road Travel		19.90		
Paved Road Travel		3.40		
Working Face		0.38		
Diesel Equipment Exhaust		1.00		
Wind Erosion		8.00		
Totals:		33.17		

Lenwood-Hinkley/Lenwood

Unpaved Road Travel		7.42			
Working Face		0.18			
Diesel Equipment Exhaust		0.41			
Wind Erosion		2.00			
Totals:		10.01			
Morongo Valley/Morongo Valley					
Unpaved Road Travel		1.27			
Paved Road Travel		1.47			
Working Face		0.08			
Diesel Equipment Exhaust		0.41			
Wind Erosion		2.00			
Totals:		5.23			
Phelan/Phelan					
Unpaved Road Travel		103.99			
Working Face		9.18			
Diesel Equipment Exhaust		0.47			
Wind Erosion		8.00			
Totals:		121.64			
Twentynine Palms/Twentynine Palms					
Unpaved Road Travel		2.73			
Paved Road Travel		1.85			
Working Face		0.26			
Diesel Equipment Exhaust		0.60			
Wind Erosion		2.00			
Totals:		7.44			
Victorville/Victorville					
Unpaved Road Travel		223.47			
Working Face		7.22			
Delivery Vehicle Exhaust		0.07			
Diesel Equipment Exhaust		2.28			
Wind Erosion		8.00			
Totals:		241.04			
Yermo/Yermo (15 atpdw)					
Unpaved Road Travel		0.67			
Working Face		0.11			
Diesel Equipment Exhaust		0.30			
Wind Erosion		2.00			
Totals:		3.08			
Category Totals (tpy):	**597.1**	**597.1**	**597.1**	**597.1**	

<u>Medical Facilities</u>

1990: 0.00 tpd

SIC 8062 (General Medical and Surgical Hospitals)

	1989	1990	1991	1992
Hi-Desert Medical Center/Joshua Tree				
NG Incinerator	0.01	*0.01*	0.01	0.02
NG Space Heating	0.06	*0.06*	0.03	0.01
Totals:	0.07	0.07	0.04	0.03
Saint Mary Desert Valley Hospital/Apple Valley				
Two NG Boilers	*0.14*	*0.14*	*0.14*	0.14
Diesel Generator	*0.01*	*0.01*	*0.01*	0.01
Totals:	0.15	0.15	0.15	0.15
Victor Valley Hospital/Victorville				
Two NG Boilers/Cogen	*0.11*	*0.11*	0.11	0.13
Three Diesel Generators	*0.02*	*0.02*	0.02	0.01
Totals:	0.13	0.13	0.13	0.14
Category Totals (tpy):	**0.35**	**0.35**	**0.32**	**0.32**

Military Bases
1990: 0.20 tpd

SIC 9711 (National Security Administration)

	1989	1990	1991	1992
China Lake Naval Air Weapons Station				
Data not tabulated				
Edwards Air Force Base/Phillips Laboratory				
Rocket Test Stands	0.46	22.64	3.10	6.80
Totals:				
George Air Force Base/Victorville				
Aerospace Ground Equip.	8.81	8.81	8.81	
Aircraft Flying Operations	19.60	19.60	14.03	
Aircraft Ground Operations	0.26	0.26	0.40	
Fire Training Operations	5.53	5.53	4.50	
Boilers and Space Heaters	2.09	2.20	2.69	
Base Housing	1.55	1.58	1.89	
Emergency Generators	0.08	0.11	0.05	
Hospital Incinerator	0.03	0.03	0.02	
Military Ground Vehicles	1.34	1.34	1.34	
Civilian Ground Vehicles	1.41	1.41	1.41	
Totals:	40.70	40.87	35.14	
USMC Logistics Base Nebo Annex/Barstow				
Nineteen Diesel IC Engines	1.79	1.65	2.51	
Seven Natural Gas Boilers	1.53	0.96	0.56	

Gasoline Vehicles	0.22	1.28	0.47	
Totals:	3.54	3.89	3.54	3.54
USMC Logistics Base/Yermo				
Four Natural Gas Boilers	0.65	0.96	0.37	
Diesel Combustion	4.46	3.84	3.39	
Gasoline Vehicles	0.46	0.39	0.31	
Totals:	5.57	5.19	4.07	4.07
Category Totals (tpy):	**50.27**	**72.59**	**45.85**	

<u>Mineral Mining</u>
1990: 1.69 tpd

SIC 1099 (Metal Ore Mining)
SIC 1422 (Crushed and Broken Limestone Mining)
SIC 1453 (Fire Clay Mining)
SIC 1499 (Miscellaneous Non-Metallic Mineral Mining)
SIC 3295 (Ground or Treated Minerals Manufacturing)

	1989	1990	1991	1992
Boral Resources Bryman Pit/Oro Grande				
Two Diesel IC Engines		0.03	0.16	
Aggregate Plant		1.50	2.28	
Screening Plant			0.17	
Materials Handling		1.30		
Storage Piles			0.08	
Front End Loader			0.09	
Road Dust		4.04		
Totals:	6.87	6.87	2.79	2.79
Brubaker-Mann/Barstow (89:42k, 90:46k)				
Aggregate Plant	0.47	0.49		
Stockpiles	0.56	0.56		
Diesel Mobile Equipment	0.32	0.31		
Totals:	1.35	1.36	1.36	1.36
Calico Rock Products/Barstow (50k tput)				
Milling	10.99			
Blasting	2.01			
Wind Erosion (4 ac.)	1.28			
Road Hauling	10.89			
Mobile Diesel Equipment	1.26			
Totals:	26.43	26.43	26.43	26.43
CalWest Rock/Newberry Springs (89:934k, 90:721k, 91:616k)				
Aggregate Plant	0.90	0.84	0.36	
Drilling	0.01	0.01	0.01	
Blasting	*37.36*	*28.84*	*24.64*	

Stockpiles	3.25	1.97	1.84	
Diesel Mobile Equipment	0.92	1.19	1.61	
Gasoline Mobile Equipment	*0.03*	*0.03*	0.03	
Totals:	42.47	32.88	28.49	28.49
Crystal Hills Sand & Gravel/Lucerne Valley (89:304k, 90:260k, 91:332k)				
Aggregate Plant	25.24	0.62	0.79	
Quarrying	1.03	*1.03*	*1.03*	
Storage Piles	3.95	0.71	0.16	
Haul Roads	34.89	1.24	0.54	
Diesel Mobile Equipment	1.44	0.60	0.91	
Totals:	66.55	4.20	3.43	3.43
Graham Equipment/Victorville-#1019 (90:47k)				
Crusher	*15.22*	*15.22*	15.22	
Diesel Generator	0.30	*0.30*	*0.30*	
Totals:	15.52	15.52	15.52	15.52
Graham Equipment/Apple Valley-#1233				
Crusher	3.43	*3.43*	3.43	
Diesel Generator	*0.08*	0.08	*0.08*	
Totals:	3.51	3.51	3.51	3.51
Hi-Grade Materials/Lucerne Valley (89:678k, 90:736k, 91:448k)				
Diesel Generator	1.24	*1.35*	0.98	
Aggregate Batch	19.30	*20.95*	15.02	
Storage Piles (20 acres)	7.89	14.72	6.39	
Vehicular Traffic	4.79	5.66	7.02	
Totals:	33.22	42.68	29.41	29.41
Owl Rock Products/Barstow #244 (89:154k, 90:144k)				
Aggregate Plant	0.38	0.18	0.12	
Diesel Combustion		0.01		
Totals:	0.38	0.19	0.12	0.12
Partin Limestone/Lucerne Valley (89:41k, 90:85k, 91:142k, 92:134k)				
Packing System	2.03	2.03	1.93	1.23
Crushing System	3.16	6.53	10.99	10.51
Pulverizing System	2.98	6.67	11.72	4.91
Four Diesel IC Engines	0.09	0.10	*0.10*	0.40
Storage Piles	0.10	0.37	0.39	0.73
Unpaved Roads	2.65	2.65	3.56	3.34
Diesel Plant Equipment	1.53	1.24	1.83	1.20
Gasoline Plant Equipment	0.02	0.02	0.02	*0.02*
Totals:	12.56	19.61	30.54	22.34
Pluess-Staufer/Lucerne Valley (89:398k, 90:317k, 91:309k)				
Primary Crusher	0.47	0.12	0.14	
Rock Storage System	1.55	1.94	1.90	
Rock Reclaim	0.03	*0.05*	0.05	
Secondary Crusher	0.25	0.23	0.27	

Undersize Screening	0.06	0.08	0.07	
Mills	1.74	1.31	1.62	
LPG/Oil Heaters	0.05	0.03	0.13	
Truck Bulk Loadouts	6.07	7.36	0.91	
Coarse Packaging	0.14	0.03	0.02	
Fine Packaging	0.02	0.01	0.01	
Surface Treatment	0.02	0.01	0.01	
Bagging	0.02	---	---	
White Knob Crusher	---	---	3.18	
Two IC Engine Gensets	*0.06*	*0.06*	0.06	
Bulk Storage Silo	*0.13*	*0.13*	0.13	
Fine Packing Silo	0.21	0.23	0.09	
Feed R&M Mills Silo	1.43	0.27	0.29	
Diesel Vehicles	1.01	1.00	1.12	
Gasoline Vehicles	*0.08*	0.08	0.05	
Quarry & Crusher Vehicles	*0.35*	0.35	0.80	
Quarry & Plant Vehicles	*0.26*	0.26	0.77	
Crusher & Piles Vehicles	*0.80*	0.80	1.28	
Overburden Pile Vehicles	8.42	1.08	8.63	
Ore Stockpiles	0.20	0.09	0.09	
Overburden Piles	32.14	17.97	7.51	
Main Plant Waste Pile	*3.11*	*3.11*	3.11	
Blasting	35.96	18.50	24.23	
Unpaved Road Travel	67.98	79.31	18.97	
Wind Erosion Plant Area	21.54	2.15	2.15	
Wind Erosion Haul Roads	47.50	4.75	4.75	
Totals:	231.60	141.31	82.34	
Rheox Plant/Newberry Springs (89:13k, 90:13k, 91:14k)				
Spray Dryer	0.37	0.48	0.49	
Williams Mill Crusher	0.48	0.51	0.46	
Raymond Mill	0.45	0.29	0.30	
Drum Dryers	0.72	0.48	0.16	
NG Boiler/Dryer	0.62	0.75	0.35	
Diesel IC Engines	1.41	1.68	1.68	
Handling/Stockpiles	0.62	0.77	0.84	
Wind Erosion	1.68	1.68	0.88	
Totals:	6.35	6.64	5.16	5.16
Rheox Mine/Hector (89:20k, 90:16k, 91:14k)				
Milling/Screening	1.51	1.49	1.32	
Handling/Stockpiles	3.80	4.03	3.37	
Wind Erosion	7.54	7.61	3.13	
Unpaved Roads	58.76	117.52	23.02	
Blasting	0.81	0.64	0.56	
Totals:	72.42	131.29	31.40	31.40
Sierra Aggregate/Lucerne Valley				

Diesel Combustion	0.10	0.11	0.49	0.60
Crushing/Screening Circuit	7.16	4.45	0.50	1.91
Totals:	7.26	4.56	0.99	2.51
Specialty Minerals/Lucerne Valley (89:848k)				
Hi-Pflex		0.08	0.14	
Primary Rock Crusher	4.24	5.56	3.30	
Boulder Makeup		0.57	0.31	
Screening System		0.07	0.27	
Feed System RMS 3 - 5		1.03	0.48	
Loading Stockpile	3.78	5.41	6.59	
Raymond Mill #5		0.80	0.90	
Roof Rock Loadout		0.04		
Glass Sand Loadout		0.96	0.12	
Dry Sizer System	3.90	2.89	7.21	
Prim. Crusher & Reclaim		1.41	1.19	
Glass Sand Recycle		0.96	1.79	
Pebble System Mill #1		0.13	0.66	
Pebble System Mill #2		0.09	0.72	
Raymond System Mill #4		0.40	0.31	
#2 Sand Truck Loadout		0.18	0.28	
Raymond System Mill #3		0.84	0.84	
Raymond System Mill #2		0.40	0.24	
Raymond System Mill #1		0.40	0.10	
Mill Screen System		0.12	1.02	
Bulk Dust Loadout			0.05	
MOB Station Packer		0.16	0.05	
Met Stone Loadout		0.04		
Met Stone Feed		0.01	0.52	
RGR/PKR Packer/Loadout		0.07	0.15	
Stone Withdrawal System	3.78	3.68	7.16	
Cage Mill	0.00		0.90	
Slurry System			0.02	
Reclaim System Conveyors		2.75	0.40	
Blender Feed System		2.06	0.61	
Blender to Silo		1.03	1.17	
Secondary Mill Screening		1.01		
Grit Packers		0.02		
RM Discharger 1 & 2		0.99	1.97	
Mobile Packer System	2.63	2.54	0.29	
Classifier Turbo #1		0.11	0.26	
Burner Dry Sizer		0.15	2.46	
Boulder Loadout Silos			0.08	
Raymond Mill #6		0.75	3.26	
Hi-Pflex Silo			0.21	
RM 5 Feed Silo		0.02	0.56	

RM 5 Loadout Silo		0.07	2.27	
Hot Dust Surge System		0.08		
Crushed Rock Storage		0.05		
Rock Storage		0.02		
Hot Storage Tank		0.01		
Mill Feed Storage		0.08		
Boulder Storage Bins		0.06	0.14	
Glass Sand Silos		0.04		
Bulk L/O Silos		0.02		
Gas & Diesel Vehicles	2.76	*2.76*	2.57	
Quarry Activity	*33.92*	19.50	42.00	
Unpaved Roads	20.75	25.94	9.17	
Stockpiles	8.04	7.83	*7.83*	
Blender to Silo	*1.17*	*1.17*	1.17	
Plant area wind erosion	64.62	55.20	45.77	
Haul road wind erosion	9.96	1.00	1.00	
Totals:	159.55	151.56	158.51	
Victorville Industrial Minerals/Oro Grande (89:205k, 91:205k)				
Quarrying	*8.20*	*8.20*	*8.20*	
Drilling	*0.02*	*0.02*	0.02	
Haul Roads	7.71	*7.71*	3.87	
Stockpiles	0.33	*0.33*	0.27	
Aggregate Loadout	1.88	*1.88*	1.49	
Secondary Crushing	2.10	*2.10*	2.57	
Stacking	2.95	*2.95*	3.08	
Primary Crushing	4.90	*4.90*	2.76	
Gasoline Equipment	0.01	*0.01*	0.00	
Diesel Equipment	0.49	*0.49*	0.24	
Totals:	28.59	28.59	22.50	22.50
Category Totals (tpy):	**714.63**	**617.20**	**442.5**	**373.17**

Miscellaneous Manufacturing
1990: 0.04 tpd

SIC 3211 (Flat Glass Manufacturing)
SIC 3479 (Miscellaneous Metal Coating)
SIC 3728 (Aircraft Parts and Auxiliary Equipment)
SCC 3-05-014-03 (Furnace)
SCC 3-09-015-01 (Milling Tank)

	1989	1990	1991	1992
Aerochem/El Mirage				
Two Natural Gas Boilers	0.23	0.16	0.11	0.03
Misc. Diesel & LPG	0.03		0.03	0.01

Grit Sandblasting	0.02		0.01	
Totals:	0.28	0.16	0.15	0.04
AFG/Victorville				
Natural Gas Furnace	10.10	9.87	8.92	9.19
Cullet Handling		1.95	1.74	0.01
Raw Material Handling	0.96	0.97	1.05	0.09
Diesel IC Engine	0.28	0.62	0.11	0.11
Diesel Motor Vehicles	0.09	0.07	0.04	0.08
Cooling Tower	1.42	1.42	1.42	1.42
Totals:	12.85	14.90	13.28	10.90
Lockheed/Helendale				
Four Diesel IC Engines	*0.02*	0.02	*0.02*	0.02
National-Arnold Magnetics/Adelanto				
Six NG Ovens				0.04
NG Turnkey Furnace				0.01
Totals:	---	---	---	0.05
Northwest Pipe & Casing/Adelanto				
Natural Gas Boiler			0.05	
Shot Blaster			0.05	
Mobile Equipment			1.51	
Batch Plant Cement			0.17	
Batch Plant Sand			0.24	
Sandblasters			6.10	
Totals:	---	---	8.12	8.12
Old Quaker Paint/Victorville				
Diesel Combustion	0.03	0.03	0.03	0.03
PDM Steel/Hesperia				
Two Diesel Generators---	---	---	0.12	
Category Totals (tpy):	**13.18**	**15.11**	**21.57**	**19.28**

<u>Natural Gas Utilities</u>
1990: 0.06 tpd

SIC 4923 (Gas Transmission and Distribution)
SCC 2-02-002-02 (Industrial IC Engine Natural Gas Reciprocating)

		1989	1990	1991	1992
Pacific Gas & Electric/Hinkley					
NG IC Engines	9.24	9.24	10.13	8.81	
Diesel IC Engines		0.00	0.04	0.04	0.06
Totals:		9.24	9.28	10.17	8.87
Southern California Gas/Adelanto					
Natural Gas Turbine		5.46	7.22	6.64	2.44
NG IC Engine		0.08	0.11	0.12	0.05

	1989	1990	1991	1992
Totals:	5.54	7.33	6.76	2.49
Southern California Gas/Newberry Springs				
Seven NG IC Compressors	5.87	6.03	5.95	4.91
Three NG IC Generators	0.30	0.24	0.26	0.26
Totals:	6.17	6.27	6.21	5.17
Category Totals (tpy):	**20.95**	**22.88**	**23.14**	**16.53**

<u>Public Wastewater Treatment Plants</u>
1990: 0.00 tpd

SIC 4952 (Sewerage Systems)

	1989	1990	1991	1992
Barstow Wastewater Treatment Plant/Barstow				
Natural Gas IC Engine				0.11
Sewer Sludge Incinerator				0.01
Totals:	0.13	0.13	0.13	0.13
Victor Valley Wastewater Reclamation Authority/Victorville				
IC Engine		0.20	0.14	
Flare		0.12	0.03	0.02
Totals:	0.12	0.12	0.23	0.16
Category Totals (tpy):	**0.25**	**0.25**	**0.36**	**0.29**

<u>Railroad Depot</u>
1990: 0.00 tpd

SIC 4013 (Railroad Switching)

	1989	1990	1991	1992
Atchison, Topeka & Santa Fe/Barstow				
Diesel Test Cell	*0.02*	*0.02*	0.02	
Two NG Steam Generators	0.22	0.22	0.01	
Diatom. Earth/Sand Handling	0.73	0.10	*0.11*	
Misc. Kerosene & Natural Gas0.01	0.01	0.01		
NG Incinerator	0.61	0.56	---	
Gasoline Mobile Equipment	*0.14*	*0.14*	0.14	
Diesel Mobile Equipment	*0.07*	*0.07*	0.07	
Category Totals (tpy):	**1.80**	**1.12**	**0.36**	**0.36**

<u>Soil Remediation</u>
1990: 0.00 tpd

SIC 1442 (Construction Sand and Gravel)

	1989	1990	1991	1992

TPS Technologies/Adelanto

Kiln				3.39
Soil Cooling				0.87
Totals:	---	---	---	4.26

IV. Area and Off-Road Sources

For the purposes of this document, area sources are typically composed of many individually small but collectively significant sources. PM_{10} emissions in tons per year are estimated for each category. 1990 activity rate, PM emission factor, and the fraction of PM emitted as PM_{10} are also presented for each category. In addition, if similar activities occurred within the unclassified area, SVPA and/or the PVV the activity rate for those areas is presented. Population and geographic area fractions are used as disaggregation surrogates. Each category is disaggregated from the MDAQMD total. Population fractions are MDPA 95.6%, unclassified 3.3%, and SVPA 1.1%. Geographic fractions are MDPA 24.2%, unclassified 72.7%, and SVPA 3%. The SVPA and PVV activity rates are presented for informational purposes only. "Methods for Assessing Area Source Emissions in California," CARB September 1991, is the primary area source methodology reference. Details on each category's emissions estimation method are presented as appropriate.

	PM_{10} (tpy)
47308/9309300200 **Wildfires - Grass and Woodland**	
125 acres burned at 33.6 # PM/acre burned (0.88 PM_{10} fraction)	1.85
(374 acres in unclassified area, 16 acres in SVPA)	

CARB methodology. Activity data from California Department of Forestry and United States Forest Service; last updated 1989. PM emission factor from Joshua Tree National Monument study. Geographic disaggregation.

47316/ **Wildfires - Timber & Brush**	
374 acres burned at 630 # PM/acre burned (0.88 PM_{10} fraction)	103.67
(1123 acres in unclassified area, 47 acres in SVPA)	

CARB methodology. Activity data from California Department of Forestry and United States Forest Service; last updated 1989. Emission factor from AP-42. Geographic disaggregation

82115/6106000230 **Wood-Burning Stoves**	
4157 tons burned at 31.1 # PM/ton burned (0.92 PM_{10} fraction)	59.47
(237 tons in unclassified area, 48 tons in SVPA)	
82123/6106020230 **Wood-Burning Fireplaces**	
16032 tons burned at 34.6 # PM/ton burned (0.92 PM_{10} fraction)	255.17
(915 tons in unclassified area, 187 tons in SVPA)	

CARB methodology. Activity from California Energy Commission fuels report; last updated 1991. Emission factor from AP-42. Population disaggregation.

47381/6306345400 **Road Construction**

2995 acre-months at 1200 # PM/a-m disturbed (0.64 PM_{10} fraction) 1150.08
(0 acre-months in SVPA)

CARB methodology, each freeway mile constructed equals 12.1 acres disturbed, each highway mile equals 9.2 acres disturbed, and each city & county mile equals 7.8 acres disturbed. Assumes each acre of city and county road has six months of construction activity. Activity from local jurisdiction construction records in miles paved: Apple Valley 23, Barstow 1, Hesperia 5, Adelanto 15, Victorville 18, rest of County 2. Emission factor from AP-42; assumes 50% control due to watering.

47365/6306245400 **Commercial Construction**

1488 acre-months at 2400 # PM/acre-month (0.64 PM_{10} fraction) 1142.78
(19 acre-months in SVPA)

47373/6306265400 **Industrial Construction**

1196 acre-months at 2400 # PM/acre-month (0.64 PM_{10} fraction) 918.53
(22 acre-months in SVPA)

54551/6306285400 **Institutional Construction**

204 acre-months at 2400 # PM/a-m disturbed (0.64 PM_{10} fraction) 156.67
(0 acre-months in SVPA)

60400/6306305400 **Governmental Construction**

29 acre-months at 2400 # PM/a-m disturbed (0.64 PM_{10} fraction) 22.27
(0 acre-months in SVPA)

CARB methodology, assuming 3.7 acres disturbed per million dollars of new commercial valuation (4 acres/$million for industrial, and 4.4 acres/$million for institutional/governmental). Also assumes each acre is disturbed for eleven months. Local 1991 construction valuation data used as activity data. Emission factor from AP-42. Population disaggregation.

47357/6306225400 **Residential Construction**

6726 acre-months at 2400 # PM/acre-month (0.64 PM_{10} fraction) 5165.57
(27 acre-months in SVPA)

CARB methodology, assuming each single family living unit disturbs 0.2 acre, and each multiple family living unit 0.05 acre, at six months of construction per disturbed acre. Local 1991 housing unit construction data used as activity data. Emission factor from AP-42. Population disaggregation.

47399/6406385400 **City & County Unpaved Road Dust**

San Bernardino County Maintained Unpaved Roads
17,533,000 vmt at 6968 # PM/1000 vmt (0.36 PM_{10} fraction) 21991.00
(879,000 vmt in unclassified area, SVPA data not tabulated)

Used AP-42 unpaved road travel equation and San Bernardino County maintained road and traffic data from 1994 with construction data for the period 1989-1994. Determined 453 miles of San Bernardino County maintained unpaved roads, average 95 trips per day per mile of unpaved road, 15% silt content on road surface, 30 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels.

San Bernardino County Unmaintained Unpaved Roads
1,109,000 vmt at 6968 # PM/1000 vmt (0.36 PM_{10} fraction) 1391.00
(167,000 vmt in unclassified area, SVPA data not tabulated)

Used AP-42 unpaved road travel equation and San Bernardino County unmaintained unpaved road data from 1994. Determined 3497 miles of San Bernardino County unmaintained roads, average one trip per mile of road per day, 15% silt content on road surface, 30 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels.

City Unmaintained Unpaved Roads
745,000 vmt at 6968 #/1000 vmt (0.36 PM_{10} fraction) 933.91
(0 vmt in unclassified area, 0 vmt in SVPA, PVV not tabulated)

Used AP-42 unpaved road travel equation and local jurisdiction unmaintained unpaved road data from 1989-1994. Determined 204 miles of local jurisdiction unmaintained unpaved roads, average ten trips per mile of road per day, 15% silt content on road surface, 30 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch and three ton vehicles with four wheels. Unmaintained unpaved road mileage was estimated as follows: Adelanto 132, Hesperia 10, Victorville 62. Data has not been tabulated for other communities.

City Maintained Unpaved Roads
21,117,000 vmt at 6968 # PM/1000 vmt (0.36 PM_{10} fraction) 26486.00
(0 vmt in unclassified area, 0 vmt in SVPA, PVV vmt not tabulated)

Used AP-42 unpaved road travel equation and local city maintained road data from late 1994. Determined 609 miles of maintained unpaved roads, average 95 trips per day per mile of road, 15% silt content on the road surface, 30 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels. Local jurisdictions had the following lengths of maintained unpaved roads (in miles): Adelanto 160, Apple Valley 177, Barstow 39, Hesperia 86, Victorville 86, other communities 61.

47407/6406405400 **U.S. Forests & Parks Unpaved Road Travel Dust**

Joshua Tree National Park
11,000 vmt at 5813 # PM/1000 vmt (0.36 PM_{10} fraction) 31.97
(0 vmt in SVPA)

Used AP-42 unpaved road travel equation and Joshua Tree National Park road data for 1994. Assumed 10 miles of unpaved road, three trips per day per mile of road, 15% silt content on road surface, 25 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels.

Death Valley National Park
0 vmt at 5897 # PM/1000 vmt (0.36 PM_{10} fraction) 0.00
(47,000 vmt in unclassified area, 0 vmt in SVPA)

Used AP-42 unpaved road travel equation and Death Valley National Park road data for 1994. Assumed 43 miles of unpaved road, three trips per day per mile of road, 15% silt content on road surface, 25 mph average vehicle speed, 15 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels.

San Bernardino National Forest Unpaved Roads
1,022,000 vmt at 5806 # PM/1000 vmt (0.36 PM_{10} fraction) 1068.07
(0 vmt in SVPA)

Used AP-42 unpaved road travel equation and San Bernardino National Forest road data for 1994. Assumed 280 miles of unpaved road (of varying maintenance levels), ten trips per day per mile of road, 15% silt content on road surface, 25 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels.

San Bernardino National Forest OHV Trails
10,000 vmt at 3482 # PM/1000 vmt (0.36 PM_{10} fraction) 6.27
(0 vmt in SVPA)

Used AP-42 unpaved road travel equation and San Bernardino National Forest road data for 1994. Assumed 28 miles of unpaved OHV trail, one trip per day per mile of trail, 15% silt content on road surface, 15 mph average vehicle speed, 20 days with precipitation greater than or equal to 0.01 inch, and three ton vehicles with four wheels.

47423/6406445400 **BLM Unpaved Road Travel Dust**

Casual OHV Area Use
96,000 El Mirage visitor days at 83.5 # PM/v-day (0.36 PM10 fraction) 1442.88
175,000 Other visitor days at 259 # PM/v-day (0.36 PM_{10} fraction) 8158.50

(130,000 visitor days in unclassified area, SVPA activity is considered casual off-road use)

Used AP-42 unpaved road travel equation with BLM activity estimates for dedicated Off-Highway Vehicle Areas in visitor-days. BLM has indicated that activity estimates include activity that occurs outside of federal public lands (50 percent of El Mirage activity, and 15 percent of Johnson Valley and Stoddard Valley activity). BLM estimated: 96,000 visitor-days at El Mirage, split between motorcycles (56 percent), all-terrain vehicles (39 percent), and four-wheel drive vehicles (5 percent); and 305,000 visitor-days at other OHV areas, split between motorcycles (49 percent), all-terrain vehicles (33 percent), and four-wheel drive vehicles (18 percent). Each visitor day is estimated to represent an average of 120 miles of vehicular travel (60 miles at El Mirage). Equation inputs are silt content of 15%, 15 days with precipitation >= 0.01 inches, and the following vehicle specific inputs: motorcycles (35 mph, 2 wheels, and 0.2 ton), ATV's (30 mph, 4 wheels, and 0.3 ton), and four-wheel drive vehicles (25 mph, 4 wheels, and 3 tons).

Casual Route Use
1,066,000 vmt at 3942 # PM/1000 vmt (0.36 PM_{10} fraction) 756.00
(5,781,000 vmt in unclassified area, 75,000 vmt in SVPA, 621,000 vmt in PVV)

Used AP-42 unpaved road travel equation with BLM activity and casual use area data from 1994. Assumed casual vehicle use was spread evenly over non-wilderness and non-OHV areas at 672 vmt per square mile per year. Equation inputs are average vehicle speed of 20 mph, silt content of 15%, 15 days with precipitation >= 0.01 inches, mean vehicle weight of 2.5 tons, and vehicles with 3.6 average wheels. Approximate area in square miles open to casual route use are as follows (assumes no casual vehicle use in wilderness, critical or other closed areas, and does not include OHV area use): Barstow 1571 (1662 in unclassified area), Needles 0 (6688 in unclassified area), Palm Springs 15 (902 in PVV), Ridgecrest 0 (195 in unclassified area, 111 in SVPA), and Yuma 0 (57 in unclassified area, 22 in PVV).

Ridgecrest Resource Area Focused Unpaved Road Travel
0 vmt at 6968 # PM/1000 vmt (0.36 PM_{10} fraction) 0.00
(3,000 vmt in unclassified area, 0 vmt in SVPA)

Used AP-42 unpaved road travel equation with BLM activity records for specific residence and business-related unpaved road activity. Estimated 3000 annual light passenger vmt from two residences. Assumed four wheels, three tons, 30 mph average speed, silt content of 15%, and 20 wet days.

Ridgecrest Resource Area Cuddeback Lake Filming Activity
0 vmt at 3326 # PM/1000 vmt (0.36 PM_{10} fraction) 0
0 acre-days at 11.5 # PM/acre-day (0.5 PM_{10} fraction) 0
(3,500 vmt and 525 acre-days in unclassified area, 0 vmt and acre-days in SVPA)

Barstow Resource Area El Mirage Lake Filming Activity
600 vmt at 3326 # PM/1000 vmt (0.36 PM_{10} fraction) 0.36
90 acre-days at 11.5 # PM/acre-day (0.5 PM_{10} fraction) 0.26
(0 vmt and acre-days in unclassified area, 0 vmt and acre-days in SVPA)

Used AP-42 unpaved road travel equation with BLM activity records and estimates for Cuddeback and El Mirage Lakes filming activities. Estimated 35 filming events per year at Cuddeback and 6 per year at El Mirage, with an average of 35 vehicles (of mixed types) covering 100 miles per event. Assumed average five wheels, five tons, 20 mph, silt content of 15%, and 20 wet days. Also estimated three days of filming on five acres per event, averaging 525 acre-days of disturbance per year. Disturbance emissions were estimated using USDA agricultural wind erosion equation, with unpaved road activity assumptions.

Organized Off-Road Event Travel
523,000 motorcycle vmt at 1251 # PM/1000 vmt (0.36 PM_{10} fraction) 117.77
165,000 four wheel vmt at 11785 # PM/1000 vmt (0.36 PM_{10} fraction) 350.01
2,520 El Mirage vmt at 49510 # PM/1000 vmt (0.36 PM_{10} fraction) 22.46
(389,000 motorcycle vmt and 123,000 four wheel vmt in unclassified area, 624,000 vmt in SVPA)

Used AP-42 unpaved road travel equation with BLM permit records, including specific data for El Mirage. BLM estimated an average of 38 motorcycle events and 12 four-wheel drive events, with 300 participants covering 80 miles at 50 mph. El Mirage was estimated to have 700 participants covering 1.2 miles in three heats at 210 mph. Other equation inputs were silt content of 15%, 20 wet days, four wheels (two wheels for motorcycles), and three tons (0.2 ton for motorcycles).

47431/6406465400 **Farm Road Unpaved Road Dust**
121,000 vmt at 5063 # PM/1000 vmt (0.61 PM_{10} fraction) 186.85
(2,000 vmt in unclassified area, 0 vmt in SVPA)

CARB methodology using AP-42 unpaved road equation, assuming 1.25 vmt per grape cropland acre per year or 4.38 vmt per other cropland acre per year, silt content of 18%, average vehicle speed of 30 mph, two ton mean vehicle weight, four-wheeled vehicles, and 15 days with precipitation >=0.01 inches. 1265 acres of grape cropland and 28223 acres of other cropland, based on San Bernardino Agricultural Commissioner 1991 data. Population disaggregation.

47597/8208201210 **Locomotive Line Haul Exhaust**
19,927,000 gal at 15.47 # PM/1000 gal burned (0.96 PM_{10} fraction) 147.97
(9,964,000 gal burned in unclassified area, 934,000 gallons burned in SVPA)

47605/8208221210 **Locomotive Switching Exhaust**
1,405,000 gal at 15.66 # PM/1000 gal burned (0.96 PM_{10} fraction) 10.56

(0 gallons burned in SVPA)

CARB methodology, obtained from Booz-Allen & Hamilton California locomotive activity report, August 1992. This report used specific engine emission factors obtained from manufacturers & source tests and railroad locomotive activity records.

47324/ **Structural Fires**

349 fires at 21.11 # PM/fire (0.98 PM_{10} fraction) 3.61
(20 structural fires in unclassified area, 4 structural fires in SVPA)

57307/ **Automobile Fires**

343 auto fires at 17 # PM/fire (0.997 PM_{10} fraction) 2.91
(20 auto fires in unclassified area, 4 auto fires in SVPA)

CARB methodology, using AP-42 emission factors for municipal refuse (assuming 1.95 tons burned per fire) and automobile components. Activity data obtained from California Fire Incident Reporting System, last updated in 1990. Population disaggregation.

54379/ **Light Duty Diesel Mobile Equipment**

530,000 gal at 26.24 # PM/1000 gal burned (0.96 PM_{10} fraction) 6.68
(30,000 gallons burned in unclassified area, 18,000 gallons burned in SVPA)

54387/ **Light Duty Gasoline Mobile Equipment Exhaust**

137,000 gal at 1.4 # PM/1000 gal burned (0.994 PM_{10} fraction) 0.09
(8,000 gallons burned in unclassified area, 4,000 gallons burned in SVPA)

54429/ **Light Duty LPG Mobile Equipment Exhaust**

144,000 gallons at 1.5 # PM/1000 gallons burned (1.0 PM_{10} fraction) 0.11
(8,000 gallons burned in unclassified area, 5,000 gallons burned in SVPA)

CARB methodology using AP-42 emission factors. Light duty is defined as less than 175 horsepower. Activity data estimated for 1990 using Power System Research load factors and annual hours of operation. Population disaggregation.

/ **Wind Erosion Disturbed Areas (Populated)**

10,058 disturbed acres at 2352 # PM/acre (0.5 PM_{10} fraction) 5914.10
(disturbed areas in unclassified area not tabulated)

Used USDA wind erosion equation, assuming a suspension factor of 0.025, climatic factor of 2.0, and erodibility of 86. Activity estimates were generated by local jurisdictions in 1995, and they include cleared undeveloped properties and developed single family residential lots with little or no landscaping. Incorporated area was estimated to have up to 8 percent disturbed, with unincorporated 'sphere of influence' areas at most 4 percent disturbed. Local jurisdictions had the following disturbed acreage: Adelanto 672, Apple Valley 1306, Yucca Valley 732, Hesperia 500, Victorville 3048, Barstow 600, Twentynine Palms 900, Needles 200, Joshua Tree 600, Lucerne Valley 600, and Phelan 900.

83352/ **Wind Erosion Unpaved Roads**

17395 unpaved road acres at 4183 # PM/acre (0.5 PM_{10} fraction) 18190.82

(7027 unpaved road acres in unclassified area, 915 unpaved road acres in SVPA, 2218 in PVV)

CARB methodology using USDA wind erosion equation, assuming a suspension factor of 0.038, climatic factor of 2.0, and erodibility of 86. 1628 miles of unpaved road in BLM Resource Areas (4831 miles in unclassified area, 302 miles in SVPA and 732 miles in PVV), assumed average width of 12 feet. 531 miles of maintained San Bernardino County unpaved roads, assumed average width of 35 feet. 3497 miles of non-maintained San Bernardino County unpaved roads, assumed average width of 20 feet. 609 miles of maintained city unpaved roads, assumed average width of 35 feet, and 204 miles of unmaintained city roads, assumed average width of 25 feet. 361 miles of forest and park unpaved roads, assumed average width of 25 feet.

83337/ **Wind Erosion Agricultural Lands**

164 acres of misc. veg. at 2352 # PM/acre (0.5 PM_{10} fraction) 96.43

(0 acres in unclassified area, 0 acres in SVPA)

CARB methodology using USDA wind erosion equation, assuming a suspension factor of 0.025, climatic factor of 2.0, and erodibility of 86. Assumed that miscellaneous vegetables are the only crop with significant windblown emissions. San Bernardino County Agricultural Commissioner estimated 164 acres of miscellaneous vegetables in 1991.

Wind Erosion BLM Sheep and Cattle Grazing Allotments

Ridgecrest Resource Area

20 acres disturbed at 2352 # PM/acre (0.5 PM_{10} fraction) 11.76

(41 acres in unclassified area, 11 acres in SVPA)

Barstow Resource Area

0 acres disturbed at 2352 # PM/acre (0.5 PM_{10} fraction) 0

(1140 acres in unclassified area)

Used USDA wind erosion equation, with identical assumptions to Agricultural Lands. Area in allotments determined from BLM maps and information as of 1994, showing cattle grazing on Pilot Knob (50 square miles) in 1989 (70 head) and 1990 (40 head), and sheep grazing on Lava Mountain and Monolith Cantil (93 square miles total) since 1990. Sheep herds varied from 2400 to 3500 head (10,000 head of sheep spring grazing in the Barstow Resource Area on approximately 175,000 acres). In the Barstow Resource Area, 562 head of cattle graze 365,000 acres year round on average, with 235 additional head of cattle winter grazing. Cattle are assumed to graze approximately 100 acres per head, disturbing 1% of each acre over two months. Sheep are assumed to graze approximately 20 acres per head, also disturbing 1% of each acre over two months. Ridgecrest Resource Area has 199 square miles of grazing allotments, some inactive due to tortoise (35 square miles in the SVPA). The Barstow Resource Area has 885 square miles of grazing allotments.

47464/ **Off-Road Motorcycle Exhaust (Trail Bikes)**
183,000 gal at 1.14 # PM/1000 gal burned (0.994 PM_{10} fraction) 0.10
(10,000 gallons burned in unclassified area, 6,000 gallons burned in SVPA)

83477/ **Off-Road All Terrain Vehicle Exhaust**
213,000 gal at 0.9 # PM/1000 gal burned (0.994 PM_{10} fraction) 0.10
(12,000 gallons burned in unclassified area, 7,000 gallons burned in SVPA)

CARB methodology using Booz-Allen & Hamilton and CARB emission factors, and activity information derived from the Motorcycle Industry Council and DMV data. Population disaggregation.

47142/ **Industrial Natural Gas Combustion**
120 mmcuft at 10 # PM/mmcuft burned (1.0 PM_{10} fraction) 0.60
(7 mmcuft burned in unclassified area, 4 mmcuft burned in SVPA)

Emissions estimated using utility-reported industrial natural gas consumption. Emission factor source unknown. Population disaggregation.

47167/ **Commercial/Institutional Unspecified Natural Gas Combustion**
361 mmcuft at 19 # PM/mmcuft burned (1.0 PM_{10} fraction) 3.43
(21 mmcuft burned in unclassified area, 4 mmcuft burned in SVPA)

58735/ **Commercial/Institutional Natural Gas Space Heating**
201 mmcuft at 19 # PM/mmcuft burned (1.0 PM_{10} fraction) 1.91
(11 mmcuft burned in unclassified area, 2 mmcuft burned in SVPA)

58743/ **Commercial/Institutional Natural Gas Water Heating**
75 mmcuft at 19 # PM/mmcuft burned (1.0 PM_{10} fraction) 0.71
(4 mmcuft burned in unclassified area, 1 mmcuft burned in SVPA)

Emissions estimated assuming utility-reported commercial/institutional natural gas consumption could be allocated as follows: 57% unspecified, 31% space heating, and 12% water heating. Emission factor source unknown. Population disaggregation.

58727/ **Commercial/Institutional LPG Combustion**
160,000 gal burned at 10 # PM/1000 gal burned (1.0 PM_{10} fraction) 0.80
(9,000 gallons burned in unclassified area, 2,000 gallons burned in SVPA)

47217/6109950120 **Residential LPG Combustion**
3,425,000 gal at 0.28 # PM/1000 gallons burned (1.0 PM_{10} fraction) 0.48
(195,000 gallons burned in unclassified area, 40,000 gallons burned in SVPA)

CARB methodology. Uses AP-42 emission factor and activity data (propane sales data) gathered from local propane suppliers. Activity data last updated 1994. Population disaggregation.

54353/8608841210 **Mobile Diesel Refrigerators**
3,012,000 hp-hr at 1.76 # PM/1000 hp-hr (0.96 PM_{10} fraction) 2.54
(172,000 hp-hr within the unclassified area, 99,000 hp-hr within SVPA)

CARB methodology, using emission factors and activity data from Booz-Allen & Hamilton study, last updated 1992. Population disaggregation.

47191/6109950110 **Residential Natural Gas Combustion**
42 mmcuft at 3 # PM/mmcuft burned (1.0 PM_{10} fraction) 0.06
(2 mmcuft burned in unclassified area, 1 mmcuft burned in SVPA)

54569/6106060110 **Residential Natural Gas Space Heating**
498 mmcuft at 3 # PM/mmcuft burned (1.0 PM_{10} fraction) 0.75
(28 mmcuft burned in unclassified area, 6 mmcuft burned in SVPA)

54577/6106080110 **Residential Natural Gas Water Heating**
460 mmcuft at 3 # PM/mmcuft burned (1.0 PM_{10} fraction) 0.69
(26 mmcuft burned in unclassified area, 5 mmcuft burned in SVPA)

54585/6106100110 **Residential Natural Gas Cooking**
60 mmcuft at 3 # PM/mmcuft burned (1.0 PM_{10} fraction) 0.09
(3 mmcuft burned in unclassified area, 1 mmcuft burned in SVPA)

CARB methodology using AP-42 and American Gas Association emission factors, assuming natural gas sales reported by utilities can be allocated as follows: 47% to space heating, 43% to water heating, 6% to cooking, and 4% to unspecified. Utility sales data last updated in 1991. Population disaggregation.

47332/6206145400 **Agricultural Tilling Dust**

75821 acre-passes at 8.95 # PM/acre pass (0.45 PM_{10} fraction) 152.68
(443 acre-passes in unclassified area, 0 acre-passes in SVPA)

CARB methodology, using AP-42 equation assuming silt content of 18% and from 0.1 to 13 passes per acre, based on crop type. Acres cultivated was obtained from MDAQMD-specific data provided by San Bernardino County Agricultural Commissioner, last updated 1991. Population disaggregation.

47456/6406365400 **Paved Road Travel Dust Entrainment**

3181 million vmt at 10330 # PM/million vmt (0.46 PM_{10} fraction) 7557.74
(1363 million vmt in unclassified area, 50 million vmt in SVPA)

CARB methodology using District activity data and AP-42 paved road emission equation. Assumes 45% of vmt occurs on freeways, 38% on major streets, 10% on collector streets, and 8% on local roads. Activity data is estimated by SCAG for entire District using transportation modeling. Latest modeling was performed in 1994. 1.1% of on-road activity is allocated to SVPA, 29% to unclassified area.

47266/6706680200 **Tumbleweed Clearing/Burning Fires**

14824 tons at 33.6 # PM/ton burned (0.88 PM_{10} fraction) 219.16
(846 tons burned in unclassified area, 173 tons burned in SVPA)

47282/6706640200 **Range Improvement Fires**

77 tons at 33.6 # PM/ton burned (0.88 PM_{10} fraction) 1.14
(4 tons burned in unclassified area, 3 tons burned in SVPA)

Emissions estimated using District activity data and CARB brushfire emission factors. Assumes 15 tons/acre loading factor, and uses District and San Bernardino County open burning permits to estimate number of fires and average area cleared. Activity data last updated with 1991 information. Population disaggregation.

47449/6806761100 **Residential Gasoline Lawn & Garden Equipment**

325,000 hp-hr at 2.01 # PM/1000 hp-hr (0.994 PM_{10} fraction) 0.32
(19,000 hp-hr in unclassified area, 0 hp-hr in SVPA)

66746/6806781100 **Commercial/Institutional Gasoline Lawn & Garden Equipment**

817,000 hp-hr at 2.25 # PM/1000 hp-hr (0.994 PM_{10} fraction) 0.91
(47,000 hp-hr in unclassified area, 0 hp-hr in SVPA)

Emissions estimated using AP-42 and CARB methodology, assuming that the District has one-third the state average lawn & garden activity due to lack of vegetation. Activity data taken from Booz-Allen & Hamilton study last updated with 1989 information. Population disaggregation.

60418/6996806000 **Commercial Grills and Charbroilers**

55 charbroilers at 3000 # PM/facility (0.7 PM_{10} fraction) 57.75
(0 charbroilers in unclassified area, 0 charbroilers in SVPA)

66811/6996826000 **Commercial Deep Fat Fryers**

645 deep fat fryers at 54 # PM/fryer (0.7 PM_{10} fraction) 12.19
(0 fryers in unclassified area, 0 fryers in SVPA)

82180/6996846000 **Commercial Unspecified Cooking**

558 installations at 300 # PM/installation (0.7 PM_{10} fraction) 58.59
(0 installations in unclassified area, 0 installations in SVPA)

Emissions estimated using SCAQMD facility-based emission factors and activity data taken from District review of 1994 San Bernardino County Environmental Health Services permit list that included food preparation facilities. Equipment types were assigned to facilities based on food preparation facility type.

54411/8508761100 **Recreational Four-Wheel Drives**

254,000 gal at 8.2 # PM/1000 gal burned (0.994 PM_{10} fraction) 1.04
(15,000 gallons burned in unclassified area, 8,000 gallons burned in SVPA)

CARB methodology using activity data from DMV records and emission factors from Booz-Allen & Hamilton off-road mobile equipment study. Last updated with 1990 data. Population disaggregation.

81919/8708821100 **Heavy Duty Gasoline Mobile Equipment (Farm)**

10,000 gallons at 3.94 # PM/1000 gal burned (0.994 PM_{10} fraction) 0.02
(1,000 gallons burned in unclassified area, 0 gallons burned in SVPA)

81927/8708921210 **Heavy Duty Diesel Mobile Equipment (Farm)**

63,000 gallons at 26.4 # PM/1000 gal burned (0.994 PM_{10} fraction) 0.83

(4,000 gallons burned in unclassified area, 0 gallons burned in SVPA)

82164/8608821100 **Heavy Duty Gasoline Mobile Equipment**
451,000 gallons at 0.18 # PM/1000 gal burned (0.994 PM_{10} fraction) 0.04
(26,000 gallons burned in unclassified area, 15,000 gallons burned in SVPA)

83097/8608821210 **Heavy Duty Diesel Mobile Equipment**
30,711,000 gal at 1.37 # PM/1000 gal burned (0.994 PM_{10} fraction) 20.91
(1,753,000 gallons burned in unclassified area, 1,014,000 gallons burned in SVPA)

CARB methodology using activity data from Power System Research and emission factors from Booz-Allen & Hamilton off-road mobile equipment study. Heavy duty equipment is defined as greater than 175 horsepower. Last updated with 1990 data. Population disaggregation.

V. On-Road Mobile Source Exhaust and Tire Wear

These emissions estimates include exhaust and tire wear PM_{10} emissions for vehicular travel on paved roads; dust entrainment from vehicular travel on paved roads is described as an area source.

	1990
Light Duty Passenger Vehicles	
97796 veh, 518368 daily trips, 5511957 daily miles (0.46 PM_{10} fraction)	0.61
(41913 vehicles, 222158 daily trips, 2362268 daily miles in unclassified area)	
(1540 vehicles, 8161 daily trips, and 86775 daily miles in SVPA)	
Light Duty Trucks	
27371 veh, 106354 daily trips, 1542600 daily miles (0.46 PM_{10} fraction)	0.18
(11730 vehicles, 45581 daily trips, 661115 daily miles in unclassified area)	
(431 vehicles, 1674 daily trips, and 24285 daily miles in SVPA)	
Medium Duty Trucks	
12565 vehicles, 33840 daily trips, 495737 daily miles (0.47 PM_{10} fraction)	0.06
(3770 vehicles, 14503 daily trips, 212459 daily miles in unclassified area)	
(138 vehicles, 533 daily trips, and 7804 daily miles in SVPA)	
Heavy Duty Gasoline Trucks	
3713 vehicles, 96054 daily trips, 464580 daily miles (0.50 PM_{10} fraction)	0.11
(1591 vehicles, 41166 daily trips, 199106 daily miles in unclassified area)	
(58 vehicles, 1512 daily trips, and 7314 daily miles in SVPA)	
Heavy Duty Diesel Trucks	
1254 vehicles, 668830 daily miles (0.87 PM_{10} fraction)	2.67
(538 vehicles, 286641 daily miles in unclassified area)	
(20 vehicles and 10529 daily miles in SVPA)	
Motorcycles	
4450 vehicles, 3342 daily trips, 30800 daily miles (1.0 PM_{10} fraction) 0.01	
(1907 vehicles, 1432 daily trips, 13200 daily miles)	
(69 vehicles, 52 daily trips, and 480 daily miles in SVPA)	
Category Totals (tpd)	3.63
Category Totals (tpy)	**1323.49**

On road mobile source exhaust and tire wear emissions were calculated using two modeling systems: DTIM (SCAG) and BURDEN (CARB). The DTIM system generates vehicle activity (trips and miles traveled) using socioeconomic data (population and land uses). DTIM assumes average trip generation rates for each land use, and multiplies them by population. These trips are then allocated by a demand algorithm to establish trip lengths. The DTIM model did not cover the entire District; its coverage of the Victor Valley was extrapolated out over the remainder of the District. This trip information was validated using actual CalTrans Highway Performance Monitoring System vehicle counts on major arterials and highways. The BURDEN system uses county-specific Department of Motor Vehicles vehicle population information, CalTrans heavy duty vehicle data, and EMFAC7F emission factors to calculate emissions specific to vehicle classes. This inventory was derived from BURDEN runs made on 9/9/94 and 9/12/94.

Unclassified area data was determined as a fraction of the District-wide data, using 29 percent as the proportion. SVPA data was determined as a fraction of the District-wide data, using the SVPA fraction of the District population as the proportion (1.09 percent).

VI. *PM_{10} Emissions Inventory Summary*

(all emissions in tons per year)

Stationary Sources

Facility/Category	Growth	1990	1994	1998	2000
Cement Manufacturing	cement	943.22	943.22	943.22	943.22
Concrete and Asphalt Batch Plants	asphalt	100.70	107.75	114.80	113.79
Electric Utility and Generation	electric	175.92	177.68	177.68	177.68
General Aviation	aviation	5.00	5.60	6.20	6.65
Incinerators	emp	0.03	0.04	0.04	0.04
Landfills	HU	597.10	776.23	955.36	1038.95
Medical Facilities	emp	0.35	0.41	0.47	0.50
Military Bases	none	72.59	72.59	72.59	72.59
Mineral Mining	mineral	714.63	571.70	428.78	428.78
Miscellaneous Manufacturing	emp	15.11	17.83	20.40	21.61
Natural Gas Utilities	ngas	22.88	22.88	22.88	23.34
Public Wastewater Treatment	HU	0.25	0.33	0.40	0.44
Railroad Depot	none	1.12	1.12	1.12	1.12
Stationary Source Totals:		2648.90	2697.38	2743.94	2828.71

Area Sources

Category	Growth	1990	1994	1998	2000
Wildfires	none	105.52	105.52	105.52	105.52
Wood-Burning Appliances	HU	314.64	409.03	503.42	547.47
Road Construction Dust	none	1150.08	1150.08	1150.08	1150.08
Structure Construction Dust	const	7405.82	7405.82	7405.82	7405.82
City and County Unpaved Road Travel	none	50801.91	39957.46	29113.01	23690.81
National Forest and Park Unpaved Road Travel	none	1106.31	1106.31	1106.31	1106.31
BLM Unpaved Road Travel	blm	10848.24	14102.71	17357.18	18875.94
Farm Road Unpaved Road Travel	AG	186.85	209.27	233.56	244.77
Locomotive Exhaust	rail	158.53	155.36	152.19	152.19
Unplanned Fires	none	6.52	6.52	6.52	6.52
Light Duty Industrial Equipment	emp	6.88	8.12	9.29	9.84
Wind Erosion Disturbed Areas	none	5914.10	5914.10	5914.10	5914.10
Wind Erosion City and County Unpaved Roads	urwe	14098.00	11419.38	8740.76	7894.88
Wind Erosion BLM Unpaved Roads	none	2476.34	2476.34	2476.34	2476.34
Wind Erosion National F and P Unpaved Roads	none	111.17	111.17	111.17	111.17
Wind Erosion Agricultural Lands	AG	96.43	108.00	120.54	126.32
Wind Erosion BLM Grazing Allotments	none	11.76	11.76	11.76	11.76
Off-Road Vehicle Exhaust	pop	1.24	1.61	1.98	2.17
Natural Gas Combustion	emp	8.24	9.72	11.12	11.78
LPG Combustion	emp	1.28	1.51	1.73	1.83
Mobile Diesel Refrigerators	emp	2.54	3.00	3.43	3.63
Agricultural Tilling Dust	AG	152.68	171.00	190.85	200.01
On-Road Travel Dust Entrainment	vmt	7557.74	8993.71	10202.95	10731.99
Planned Fires	none	220.30	220.30	220.30	220.30
Gasoline Utility Equipment	HU	1.23	1.60	1.97	2.14
Commercial Food Preparation	emp	128.53	151.67	173.52	183.80
Heavy Duty Mobile Equipment	emp	21.80	25.72	29.43	31.17
Area Source Totals:		102894.68	94236.80	85354.85	81218.67

On-Road Mobile Sources

Vehicle Types	1990	1994	1998	2000
Light Duty Passenger	221.65	248.80	275.94	291.27
Light Duty Truck	65.70	71.18	76.65	81.76
Medium Duty Truck	21.90	25.55	25.55	25.55
Heavy Duty Gasoline Truck	40.15	40.88	40.88	40.88
Heavy Duty Diesel Truck	970.44	803.32	636.20	559.55
Motorcycle	3.65	3.65	3.65	3.65
On-Road Source Totals:	1323.49	1193.38	1058.87	1002.66
Mojave Desert Planning Area Totals:	106867.07	98127.55	89157.66	85050.04

Growth Codes

		1990	1994	1998	2000
Agriculture	AG	1.00	1.12	1.25	1.31
Asphalt/Concrete Batch Plants	asphalt	1.00	1.07	1.14	1.13
General Aviation	aviation	1.00	1.12	1.24	1.33
Cement Manufacturing	cement	1.00	1.00	1.00	1.00
Construction	const	1.00	1.00	1.00	1.00
Electric Utilities and Generators	electric	1.00	1.01	1.01	1.01
Employment	emp	1.00	1.18	1.35	1.43
Housing Units	HU	1.00	1.30	1.60	1.74
Mining/Mineral Processing	mineral	1.00	0.80	0.60	0.60
Natural Gas Pipelines	ngas	1.00	1.00	1.00	1.02
Population	pop	1.00	1.30	1.60	1.75
Railroad Activity	rail	1.00	0.98	0.96	0.96
Unpaved Road Wind Erosion	urwe	1.00	0.81	0.62	0.56
Vehicle Miles Traveled (on-road)	vmt	1.00	1.19	1.35	1.42
Bureau of Land Management	blm	1.00	1.30	1.60	1.74

(emissions in tons per year)			Forecasted				Controlled			
Category	**1990**	**%**	**1998**	**%**	**2000**	**%**	**1998**	**%**	**2000**	**%**
Mojave Desert Nonattainment Area	(Pop: 312202)									
City and County Unpaved Road Travel	52114	30	38043	25	34917	23				
City and County Unpaved Road Wind Erosion	14570	8	13234	9	12430	8				
Construction	8556	5	4853	3	4853	3				
City and County Disturbed Areas	5914	3	5914	4	5914	4				
DOI Activity and Lands	46047	26	38919	25	38919	26				
Misc Stationary Sources	3427	2	3815	2	3895	3				
Misc Area Sources	1841	1	2203	1	2290	2				
Fort Irwin National Training Center	23248	13	23248	15	23248	15				
USMC Air Ground Combat Center	6828	4	6828	4	6828	5				
Paved Road Dust Entrainment	10796	6	14575	10	15330	10				
Mobile Source Exhaust and Tire Wear	1891	1	1511	1	1431	1				
Total Mojave Desert:	175232		153143		150055					
Revised Nonattainment Area	(Pop: 301889)									
City and County Unpaved Road Travel	50802	48	29113	33	23691	28	27366	36	22270	31
BLM Land Activity	10860	10	17369	19	18888	22	17369	23	18888	26
Paved Road Dust Entrainment	7558	7	10203	11	10732	13	10203	14	10732	15
Misc Area Sources	1414	1	1766	2	1850	2	1766	2	1850	3
Misc. Stationary Sources	2649	2	2744	3	2829	3	2744	4	2829	4
Mobile Source Exhaust and Tire Wear	1323	1	1059	1	1003	1	1059	1	1003	1
National Park and Forest Activity	1106	1	1106	1	1106	1	1106	1	1106	2
City and County Unpaved Road Wind Erosion	14098	13	8741	10	7895	9	8479	11	7658	11
Construction	8556	8	8556	10	8556	10	1711	2	1711	2
City and County Disturbed Areas	5914	6	5914	7	5914	7	1183	2	1183	2
BLM Unpaved Road Wind Erosion	2476	2	2476	3	2476	3	2476	3	2476	3
National Park and Forest Unp. Road Erosion	111	0	111	0	111	0	111	0	111	0
Totals:	106867		89158		85051		75573		71817	
Lucerne Valley Region	(Pop: 6426)									
City and County Unpaved Road Travel	4553	64	4466	64	4444	63	4243	69	4222	69
Paved Road Dust Entrainment	111	2	150	2	158	2	150	2	158	3
Misc Area Sources	38	1	45	1	47	1	45	1	47	1
Mobile Source Exhaust and Tire Wear	19	0	16	0	15	0	16	0	15	0
Misc. Stationary Sources	783	11	783	11	783	11	274	4	274	4
City and County Unpaved Road Wind Erosion	1378	19	1369	19	1367	20	1355	22	1353	22
City and County Disturbed Areas	122	2	122	2	122	2	24	0	24	0
Construction	70	1	70	1	70	1	14	0	14	0
Totals:	7074		7021		7006		6121		6107	

APPENDIX D: RACM, NSR and RACT

RACM

This section will discuss each of USEPA's RACM, indicating which are included in the control strategy and how they will be implemented, and which are excluded from the control strategy and why. Should a significant amount of emissions occur in the future from a source category that one of these RACM applies to, the RACM will be reviewed and reconsidered for inclusion as an amendment to the plan. The RACM listed below are taken from the USEPA guidance document *PM_{10} Dust Control Guidance Document.*

Pave, vegetate or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads and unpaved parking areas. Included in the Construction and Demolition control measure.

Require haul trucks to be covered while transporting materials. Included in the Construction and Demolition control measure.

Require paving or stabilizing of permanent unpaved haul roads, and parking or staging areas at commercial, municipal or industrial facilities. Included in the Industrial Fugitive and Construction and Demolition control measures.

Pave or chemically stabilize unpaved roads associated with operations at commercial and industrial facilities. Included in the Industrial Fugitive and Construction and demolition control measures.

Establish dust control measures for material storage piles at commercial and industrial facilities. Included in the Industrial Fugitive control measure.

Require vegetation, chemical stabilization, or other abatement of wind-erodible soil, including lands subjected to water mining, abandoned farms, and abandoned construction sites. Abandoned sites which have restricted access, as is the case with commercial and industrial sites, typically stabilize naturally over the course of one winter rain season. Therefore, the District deems emissions from these sites are probably insignificant to the PM_{10} emission inventory.

Pave or chemically stabilize unpaved roads. Included for certain high-traffic roads.

Develop traffic reduction plans for unpaved roads and apply measures to encourage the use of paved roads. In the predominantly rural setting of the MDPA, local government transportation agencies cannot implement such plans because construction (paving) and enforcement programs are overwhelmingly not cost-effective. This strategy is not applicable in a rural setting.

Provide for storm water drainage to prevent water erosion into paved roads. Storm water erosion onto paved surfaces is not significant contributor to the PM_{10} emission inventory, as the MDPA receives very limited rainfall.

Provide for traffic rerouting or rapid cleaning of temporary sources of dust on paved roads. This may be possible for high traffic areas within incorporated areas but is not cost effective in a rural setting, primarily because of the limited number of paved routes available. A review of the emission inventory for the MDPA reveals that emissions from this source of dust (storm water transport and haul truck spillage) on paved roads is a minor contributor when compared to emissions from entrainment due to general traffic on the same type of road.

Require haul trucks traveling on public roadways to cover their load. Included within the Construction and Demolition and Industrial Fugitive control measures.

Require improved material specification for and reduction of usage of skid control sand or salt. This strategy is not applicable to the MDPA as these are not common practices in a dry desert type environment. The inventory cannot identify any emissions from this category within the MDPA.

Require curbing and pave or stabilize shoulders of paved roads. This is the development policy in the MDPA in relatively high density areas. It is not cost-effective for a low density, rural setting.

Require Dust Control Plans for construction or land clearing projects. Included in the Construction and Demolition control measure for projects covering 100 acres and larger. Local jurisdictions already require wind and water erosion control plans for construction activities.

Administer use of recreational vehicles on open land. The federal Desert Protection Act of 1994 and the designated off-road vehicle areas greatly restricts the use of public lands already. The cost of administering specific enforcement programs beyond those in place is not practicable nor cost-effective to the land-use regulatory agencies.

Rely upon the soil conservation requirements for the Food Security Act to reduce emissions from agricultural operations. A review of the emission inventory for the MDPA reveals that emissions from agricultural operation are insignificant. Therefore no controls on agricultural activities are proposed.

Residential wood-burning stoves regulation. A review of the MDPA emission inventory does not identify this category as being a significant contributor.

Prescribed burning of agricultural or forestry lands. This method of range/land management is not commonly practiced in the desert environment of the MDPA. In reviewing the emission inventory this source category is found to be an insignificant contributor.

NSR

The NSR program is mandated by the FCAA pursuant to Section 189(a)(1)(A). NSR is required as one element of the State Implementation Plan (SIP) when any area or region has been designated as non attainment for any criteria pollutant for which a standard has been set. NSR governs new and modified major stationary sources. "Major Source" within the context of the MDPA is any stationary source emitting 15 tons per year or more of PM_{10}. For areas designated as "moderate", the minimum level of control required is RACT.

RACT

RACT strategies apply on a case-by-case basis. A general discussion of technology follows:

<u>High Efficiency and Simple Cyclones</u>
These devises utilize centrifugal force to force the particulate to the outside wall of a cylinder. The particles migrate down the cylinder wall and are collected for disposal. The carrier gas, usually air, passes through the center of the vortex. This is a vacuum based approach to eliminate large particulate matter, and is often employed as a pretreatment before a baghouse on dry material processes. This technology may be employed on material crushing/drying/grinding/screening operations associated with coal-fired boilers fuel handling systems, cement manufacturing, and aggregate processing plants.

<u>Fabric Filter Systems (Baghouses)</u>
A widely employed pollution control technology for dry material processes which generate medium to fine dust and particulate laden gases is a large vacuum system which traps the particulate material on cloth, or other material, bags which act as filters and prevent release of particulate into the atmosphere. Pickup points are placed wherever dust is generated in the process, such as material transfer points between conveyors and stock piles, product piles, crushers, screens, and classifiers. The dust is transported through ducts to the baghouse. The entire system operates on the same principle as a home vacuum but may include tens of pickup points and a baghouse of ten to fifty or more filter bags. The whole system operates under a negative pressure which draws the material from the pickup point, through the duct and into the baghouse. Baghouse technology is employed widely and is particularly appropriate for industrial crushed/powdered mineral (such as gypsum, lime, clay, and volcanic pumice) processes, and chemical manufacturing processes such as borate products, portland cement, and asphalt batch plants.

<u>Electrostatic Precipitators (ESP's)</u>
Very fine dust particles from dry materials which can pass through filter bags may be further collected upon an electrically charged plate. The dust is ionized or "charged" by passing the particle laden exhaust gases through a high energy electric field, forming a stream of gaseous ions which are

collected downstream on charged plates. This technology may be applicable on coal-fired boilers, rotary kilns, lime kilns, and portland cement manufacturing.

Wet Scrubbers:
In applications where the dust collection is a final step before the carrier gas stream exits the process into the atmosphere, wet scrubbers may be applicable to capture medium to fine dust particles from a process stream. A pickup and delivery system may be similar to that of a cyclone/baghouse system but the particulate matter is "captured" in a fine mist or spray of water and is flushed from the scrubber to a waste water pond. This technology is water intensive but may be employed successfully in many applications where moisture does not interfere with the process. This control technology is used in conjunction with borax calcining, lime manufacturing, coal-fired boilers, rotary kilns, product dryers, and aggregate processing plants. Frequently, this technology is employed when the exhaust gas stream is at high temperatures or contains corrosive material/mists which would damage baghouse equipment.

Control Measures for Material Storage Piles
Storage piles are subject to wind entrainment of material and to fugitive dust which drops from a transfer point which feeds the pile. Lowering the drop height or enclosing the distance from the drop point to the pile with a screen or chute will reduce the opportunity for wind to capture and transport fine dust into the air. Controlling the moisture content of the material creating the pile will reduce the amount of fine dry dust available for wind entrainment and transport from the site. Protecting the storage pile from direct attack by wind with screens, fences or other enclosure may reduce the opportunity for wind entrainment of fine dust on the pile's exposed surface. Reducing the size of the pile would reduce the surface area available for wind entrainment. For piles which are not disturbed on a regular and frequent basis, such as waste product piles, such piles may be chemically stabilized, physically compacted or covered to prevent disruption of the surface integrity of the pile.

Control Measures for Process and Conveying Equipment
Reducing distances of drop from transfer point to impact point is often possible, as is shielding of the drop path with a chute or screen. Conveying equipment is frequently enclosed in screen or solid material to prevent rain water entering the product. This also which restricts the ability of wind to dry and entrain fine dust from the dry product stream. Most crushing and screening and drying equipment is enclosed to prevent loss of the product which also effectively captures potential fugitive dust.

Working Site Housekeeping
Keeping the work site clean and dust-free contributes significantly to preventing particulate matter availability for dust entrainment into the atmosphere. Clean up product spills quickly. Stabilize high traffic areas, service roads and haul roads by paving, rock covering or chemically stabilizing the traffic surface. Restrict access to areas which, when disturbed, become sources of particulate matter emissions such as parking, staging, storage and turn-around areas. Preventing "carry-out" of dust and particulate material on vehicles leaving the property by washing vehicles/tires and or covering the load. Stabilize surfaces adjacent to paved areas with vehicle access to unpaved roads and parking areas through paving, rocking or chemical treatment. Provide curbs and storm-water runoff

channels to prevent waterborne soil from being deposited on high traffic surfaces where grinding action from tires would create wind-entrainable particulate matter.

APPENDIX E: COST EFFECTIVENESS ANALYSIS

This appendix presents the methodology, assumptions, data sources and calculations used to determine the cost and cost effectiveness of the control measures set forth in the PM_{10} Plan.

I. Methodology

The implementation of PM_{10} control measures typically involves both an initial, non-recurring (capital) cost and some recurring (operation and maintenance, or O&M) costs. These two kinds of costs cannot be combined by direct addition due to their differing characteristics. Various methods are available for combining the two costs. For the purposes of this financial analysis, the discounted cash-flow (DCF) method was used to determine the cost of control. The DCF method determines the present value of the annual operating & maintenance costs over the economic life of the project and adds it to the first year capital cost to obtain a total present value. This approach can be described in equation form as follows:

$$Present\ Value = C + [A * PVF_{(n,r-i)}]$$

where:	C	=	up-front capital outlay
	A	=	annual operating & maintenance costs
	n	=	economic life of the project
	r	=	market interest rate
	i	=	inflation rate
	$PVF_{(n,r-i)}$	=	present value factor for a specific n, r & i

The present value factor can be determined by using the equation below:

$$PVF = \frac{1 - \frac{1}{(1 + r)^n}}{r}$$

The cost effectiveness of a control measure can be obtained by dividing the total present value by the emissions reduced over the economic life of the project, as follows:

$$Cost\ of\ control = \frac{Present\ Value}{Emissions\ Reduced\ Throughout\ the\ Equipment\ Life}$$

II. Calculations by Control Measure

This section provides specific financial information and calculations for each control measure analyzed.

1. Construction and Demolition

<u>Assumptions</u>

n = economic life of project = 1 year
r = real interest rate = 4%
R = annual emission reduction (tons PM_{10}/year) = 2339
c = Capital cost per acre treated (1994 $) = 200
a = Annual O&M cost per acre treated (1994 $) = 0
m = Acres controlled = 1017

<u>Calculations</u>

$$PVF = \frac{1 - \frac{1}{(1+r)^n}}{r} = 1$$

C = Capital Cost = $c * m$ = $203,400

A = O&M Cost = $a * m$ = $0

Present Value = C + (A * PVF) = $203,400

$$E = Cost\ Effectiveness = \frac{Present\ Value}{R * n} = \$90\ per\ ton$$

2. Stabilization of Unpaved Roads

The cost effectiveness analysis for this control measure is based upon stabilizing sufficient unpaved road surface to generate 1,541 tons of annual PM_{10} emission reductions. MDAQMD estimates that this could be accomplished by paving 3.65 miles of roadway, although the length of road surface ultimately paved or otherwise may be greater depending upon the specific roads (or portions thereof) selected and the stabilization methods used.

Assumptions

n =	economic life of project = 20 years
r =	real interest rate = 4%
R=	annual emission reduction (tons PM_{10}/year) = 1541
c_1	= Capital cost per mile (low) = 250,000
c_2	= Capital cost per mile (high) = 300,000
a_1=	Annual O&M cost per mile (1985 $)(low) = 6,600
a_2=	Annual O&M cost per mile (1985 $)(high) = 11,900
m=	Miles to pave = 3.65
x =	indexing factor (for converting 1985$ to 1994$) = 1.34

Calculations

$$PVF = \frac{1 - \frac{1}{(1+r)^n}}{r} = 13.6$$

C_1 =	Capital Cost (low end)	=	$c_1 * m$	=	$912,500
C_2 =	Capital Cost (high end)	=	$c_2 * m$	=	$1,095,000
A_1 =	20 yr. O&M cost (low)	=	$a_1 * m * x *$ PVF	=	$439,016
A_2 =	20 yr. O&M cost (high)	=	$a_2 * m * x *$ PVF	=	$791,559

Present Value (low) =	$C_1 + A_1$	=	$1,351,516
Present Value (high) =	$C_2 + A_2$	=	$1,886,559

$$E_1 = Cost\ Effectiveness_1 = \frac{Present\ Value\ (low)}{R*n} = \$44\ per\ ton$$

$$E_2 = Cost\ Effectiveness_2 = \frac{Present\ Value\ (high)}{R*n} = \$61\ per\ ton$$

3. Fugitive Dust Controls for Stationary Sources

The financial analysis for this control measure will cover an example project. It is expected that other industrial fugitive controls will have roughly equivalent cost effectiveness.

Assumptions

n =	economic life of project = 10 years
r =	real interest rate = 4%
R=	annual emission reduction (tons PM_{10}/year) = 171
C=	Capital cost (1994 \$) = 0
A=	Annual O&M cost (1994 \$) = 50,000

Calculations

$$PVF = \frac{1 - \frac{1}{(1+r)^n}}{r} = 8.11$$

Present Value = C + (A * PVF) = \$405,500

$$E = Cost\ Effectiveness = \frac{Present\ Value}{R * n} = \$237\ per\ ton$$

4. Minimize City and County Disturbed Area (Weed Suppression)

The cost effectiveness analysis for this control measure is based upon an example one acre lot.

Assumptions

n =	economic life of project = 10 years
r =	real interest rate = 4%
R=	annual emission reduction (tons PM_{10}/year) = 0.6
C=	Capital cost (1994 \$) = 0
A=	Annual O&M cost (1994 \$) = 200

$$PVF = \frac{1 - \frac{1}{(1+r)^n}}{r} = 8.11$$

Present Value = C + (A * PVF) = \$1,622

$$E = Cost\ Effectiveness = \frac{Present\ Value}{R * n} = \$270\ per\ ton$$

III. Data Sources

The following data sources were used for information on capital costs and annual operating & maintenance costs:

1. Construction and Demolition: USEPA Control of Open Fugitive Dust Sources, September 1988.

2. Stabilization of Unpaved Roads: USEPA Control of Open Fugitive Dust Sources, September 1988, and San Bernardino County Transportation/Flood Control Department.

3. Fugitive Dust Controls for Stationary Sources: estimate based upon representative cost of control applied by a stationary source within the MDAQMD.

4. Minimize City and County Disturbed Area (Weed Suppression): estimate of annual mowing costs.